# Instructor In-Depth Resource

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# AED Use

## Introduction

In most cases of adult cardiac arrest, a shock from a defibrillator is required to reset the heart into a normal, beating rhythm. The sooner a shock is delivered, the more likely it will work and the odds of survival are increased. Delays to defibrillation decrease the odds for survival of SCA. [1,2]

The Automated External Defibrillator (AED) can be used by citizen responders before the arrival of EMS. This section teaches responders how to use an AED and when to integrate an AED into a CPR rescue.

There are three basic steps to AED use that are performed no matter what AED type is available to the responder:[3]

1. Turn on AED
2. Follow AED Prompts
3. Resume chest compressions immediately after the shock

The likelihood of an AED being in the same room as an SCA victim is low. Most of the time, the AED will have to be retrieved quickly and brought back to the emergency scene. If two responders are available, one starts CPR and the other calls 9-1-1 and retrieves the AED. Providing effective CPR in the time between collapse and AED use provides oxygen to the brain and heart, extending the time for successful defibrillation.[1] As a general rule:

- Adults: Use an AED as soon as it is available
- Children/Infants: Use an AED after about 2 minutes of CPR (5 cycles of 30:2)

Minimize interruptions to compressions as much as possible. One rescuer continues compressions while the other rescuer readies the AED for use. Only stop CPR when the AED prompts the responder to stop.

## How to Use an AED

First power on the AED, then expose the chest. If needed, use the scissors that come with the AED to cut the victim's clothes. Cut around the hands of the responder doing CPR so he or she does not have to stop compressions.

## Power on the AED

Place the AED near the victim's head and power on the AED. AEDs turn on in different ways, depending on the model. A responder may need to push the power button, lift up the hard cover, or pull the handle on the AED pads cartridge.

Once the AED is powered on, it will begin prompting. It is important to turn on the AED before connecting the pads.

## Follow the Verbal and Visual Prompts

All AEDs have verbal prompts to guide the rescuer. AEDs also use indicator lights and lit symbols to show the rescuer visually what to do. Some AED models have text screen prompts as well as verbal and visual indicators.

## Attach Pads

When the AED is powered on it will do a brief self-check and then prompt the rescuer to connect the pads to the victim's bare skin. One pad is placed on the upper right chest between the collarbone and nipple. The other pad is placed on the left side of the chest, over the rib cage a few finger widths under the victim's armpit (axilla).

Follow the pictures on the pads for placement. Peel the first pad from the backing and press it firmly to the victim's skin. Repeat the process with the second pad.

## Stop CPR When Prompted

Only stop CPR when prompted by the AED. It will need to analyze the heart rhythm and determine if a shock is needed. The AED can't analyze the rhythm while chest compressions are being performed. If the first responder doesn't hear the prompt to stop CPR, the second responder may have to direct him to stop.

## Switch Places

When the AED is assessing the heart rhythm, there is a brief pause in CPR. If there are two rescuers, switch positions during the pause (every two minutes) so that the rescuer operating the AED can take over compressions after the shock and the first rescuer can rest. Switch every two minutes (or every AED pause) to reduce responder fatigue.[3]

## Clear the Victim

The AED will advise responders if a shock is required. Because electricity from an AED shock can travel from the victim to a bystander, responders will need to visually and verbally confirm that no one is touching the victim or the victim's clothing.

To clear the victim before a shock, scan up and down to confirm no one is in danger of being shocked. If the victim is wearing oxygen, move the mask or canula at least three feet from the victim's face. As you scan state loudly, "Clear!" or "Everybody clear!"

## Press the Shock Button

Press the shock button when you are sure everyone is clear from the victim. The victim will have a brief muscular contraction, and then relax. If an AED shock is not advised, the AED will prompt responders to resume CPR.

Not all AEDs have a shock button. Some AEDs will shock automatically. Be sure that the victim is clear before the AED shocks.

## Immediately Resume CPR

Responders should be ready to resume CPR immediately after the AED has delivered the shock. The AED will indicate when it is safe to touch the victim and start CPR. Always resume CPR starting with chest compressions.

Some models will help rescuers stay on pace with an automatic metronome for compression pacing. Continue to follow the prompts. Do not stop CPR unless the victim begins to move or the AED prompts you to stop CPR.

If the victim begins to move and is breathing normally, keep the AED pads connected. Monitor breathing until help arrives, and resume CPR/AED use if needed.

## AED Sequence

| | |
|---|---|
| 1 | Power on the AED |
| 2 | Attach Pads |
| 3 | Stop CPR (when prompted by the AED) |
| 4 | Clear the Victim |
| 5 | Press shock button (unless shocks automatically) |
| 6 | Resume CPR |

## AED Use on a Child or Infant [4]

## Age for AED Use:

- A child is between the ages of 1 and 8, or weighs less than 55 lbs.
- An infant is less than 1 year old.

**AED Use on a Child**: Use pediatric pads or equipment if available. If pediatric AED pads or equipment are not available, use adult pads or equipment.

**AED Use on an Infant**: It is best to use a manual defibrillator on an infant. If a manual defibrillator is not available, use pediatric pads or equipment. If pediatric

AED pads or equipment are not available, use adult pads or equipment. Adult AEDs have been successfully used on infants with few side effects and good outcomes. Follow local protocols for AED use on an infant.

**Pad Placement for a Child or Infant:** Do not let AED pads touch or overlap. If the victim is so small that the standard AED pad placement will not work, place one pad on the front center of the chest and the other pad on the back, 'sandwiching' the chest between the two pads.

## Special Considerations

### Very Hairy Chest

A lot of chest hair can limit the contact between the electrode pads and the skin, making it difficult for the AED to read the cardiac rhythm and deliver a shock. Use a razor to quickly shave a very hairy chest in the area of electrode placement before applying pads. If the electrodes have already been placed and the AED cannot analyze the heart rhythm, remove the pads with a quick movement to remove chest hair, and apply a new set of electrodes.

### Implanted Devices

Some people have electrical devices, such as a pacemaker or an Automated Implantable Cardioverter Defibrillator (AICD or ICD), surgically implanted into their bodies. These devices may initiate the electrical impulses for the heart, or internally defibrillate.

They appear as a small, hard, raised lump about 1 ½ inches in diameter. They are found under the skin of the chest or abdominal area. Most people will have a small scar where the device was inserted.

The presence of an implanted device does not prevent the use of an AED. However, special care should be used when applying the electrode pads to the chest. Do not place a pad directly over an implanted device. Adjust the pad location to place it at least 1 inch away from the device to avoid interfering with the delivery of a shock from the AED.

If a person's ICD does activate, the rescuer will see the person react similarly to the reaction to a shock from an AED. The ICD will not harm the rescuer. After 30-60 seconds, continue use of the AED according to CPR protocols and AED prompts.

### Medication Patches

Transdermal medications are designed to enter the bloodstream by absorption through the skin. The medication is embedded in an adhesive patch that is applied to the skin. The medication is absorbed by the skin and delivered into the bloodstream.

Using the AED over a patch can burn the skin or block the electrical impulse delivered by the AED. Use a gloved hand to remove any medication patches that interfere with pad placement and wipe the skin clean with a towel before applying the pads.

## Preparing for a Cardiac Emergency

Safety-conscious companies and organizations have an internal emergency response system that includes regular training to maximize its effectiveness. The use of an AED should be part of the practice and training. The components of the emergency response system should include:

1. Recognition of the emergency.
2. Internal notification of the emergency to a central dispatch location.
3. Activation of the corporate emergency response plan.
4. External notification (9-1-1) and dispatch of the internal response team to the victim with an AED.
5. Direction of EMS to the victim.

## Storage, Maintenance and Inspection

AED owners and operators should ensure the AED is ready for use at all times. Proper storage and inspection should be part of every AED program.

An AED should be kept in an accessible area, close to a phone. If you are locking up the AED, be sure that every trained rescuer has a key. Store an AED at room temperature, protected from the elements. Follow manufacturer's guidelines for storage.

An AED can be stored in a specially-designed storage cabinet with a transparent door for easy visibility. The cabinets are available with alarm and light strobe, if desired.

It's important to understand all of the operational components of the AED. Review the User's Manual to become familiar with the parts, their storage location, and their normal operation. Follow manufacturer's guidelines for recommended individual AED accessories.

Most AEDs perform a self-test every day or week and each time the unit is activated. If service is required, the AED should activate an alarm. Refer to the manufacturer's guidelines for recommended AED inspection and testing. Use an inspection log to record regular inspection of batteries, pads, status indicator and service indicator. Ensure that expiration dates are current, and there is no visible damage.

## Medical Direction

An AED is a medical device and requires a doctor's prescription. Most AED programs are overseen by a physician who will write the prescription, approve the

training, help develop an emergency response plan, and review AED events to provide quality assurance and improvement.

## Troubleshooting

If you perform regular maintenance and inspection of the AED, it is unlikely that the unit will fail during an emergency. If the unit identifies a problem during AED use, it will prompt you to quickly troubleshoot the problem. Have a second trained rescuer continue CPR while you are attempting to troubleshoot the problem.

AED troubleshooting prompts can include:

- Check pads
    - Press down firmly on the pads, or replace the pads with a spare set.
    - Check the pad connection to the AED.
- Low battery
    - Replace the battery and ensure connections are intact.
    - Even in a low battery condition, an AED may be able to provide several shocks.
    - Refer to the AED manufacturer for more information.
- Movement
    - Movement can disrupt the analysis of the heart rhythm.
    - When the AED is analyzing, make sure that no one is touching the victim or cables.
    - If the victim is in a moving vehicle, stop the vehicle.
- Connect electrodes
    - Check the electrode pad connector to the AED.
    - Check the pads.

## AED Safety

## Clearing the Victim

Always ‘clear’ the victim before delivering a shock. Look up and down the person and loudly state, “Clear!” or “Everybody clear!”

## Water

Water is a great conductor of electricity. Defibrillating a person who is lying in water could cause burning or shocking of rescuers or bystanders. Move a person who is lying in a puddle or pool of water to a drier area prior to AED use. Ensure that the rescuer or bystanders are not standing in water during AED use. Rain, snow, or small amounts of water will not interfere with safe AED use.

Water or sweat on a victim’s chest can interfere with defibrillation. Quickly dry the victim’s chest before attaching the pads to ensure that the pads attach securely, and that the electrical shock travels through the heart and not over the wet surface of the skin.

## Oxygen

Always consider the environment during any rescue situation. The use of an AED in a combustible environment where fumes or gases are present can be hazardous. Some people may use oxygen at home or out in the community. Concentrated, medical oxygen can be dangerous because it is combustible.

If a person is wearing oxygen, turn it off and remove the mask or cannula from the person's face before using the AED. If oxygen is being used with rescue breaths, move the delivery device several feet from the victim before delivering a shock, then resume rescue breaths with supplemental oxygen.

# Allergic Reactions

## Overview[5,6,7]

The immune system is our body's defense mechanism against foreign materials (**antigens**). It uses white blood cells (cell-mediated immunity) and proteins in the blood called **antibodies** (humoral immunity) to attack the invaders. White blood cells, also known as T lymphocytes, or T-cells, organize the immune system's fight against infection and directly attack the antigens. Antibodies, which include Immunoglobulin A, D, G, M and E, protect the respiratory and gastrointestinal systems. An **allergen** is an antigen that produces an allergic reaction.

An **allergy** is an overreaction of your body's immune system to a substance (**allergen**). Approximately 50 million Americans suffer from allergies. When a person comes in contact with an allergen, the body releases a massive amount of **histamine**, a chemical that causes allergy symptoms. More severe allergic reactions may occur depending on the amount of exposure and the sensitivity to the allergen. Allergic reactions tend to get worse with each subsequent occurrence. The quicker the onset of symptoms, the more severe the reaction.

**Allergic reactions can cause the following conditions:**

- **Allergic rhinitis:** Sneezing, nasal congestion, coughing
- **Asthma:** A more serious condition that causes wheezing and shortness of breath due to narrowing of the airways and increased mucus production.
- **Skin allergies:** Rashes, oozing blisters, hives (red raised lesions with itching and swelling) and contact dermatitis (poison ivy)
- **Food allergies**: Gastrointestinal disturbances
- **Anaphylactic shock:** The most severe result of an allergic reaction, causing swelling in the airways and a sudden drop in blood pressure. Anaphylactic shock is life threatening, and requires immediate emergency medical care. Death can occur within minutes.

A person should never self-administer antibiotics prescribed for a friend or family member due to possible allergic reactions.

Allergens can be inhaled, swallowed, or simply come in contact with the skin. Common allergens include pollen, mold spores, household dust, pet dander, dust mites, insect sting venom, shellfish, dairy products, drugs, eggs, chocolate, nuts and poisons. Although allergies to any antigen can result in anaphylaxis, peanuts, bee sting venom and penicillin can often cause a life-threatening reaction in highly allergic people.

Food is the leading cause of anaphylaxis in the community. There are about 30,000 food-induced anaphylactic reactions treated in the emergency department each year in the U.S. As many as 200 people die each year from anaphylaxis. **When signs**

**and symptoms involve more than one body system (respiratory, cardiovascular, skin, gastrointestinal), suspect anaphylaxis.**

**Signs and Symptoms:**

- Hives, rashes, itchy skin
- Swollen face, eyes, throat, tongue
- Sneezing, difficulty breathing, coughing, congestion
- Stomach cramps, vomiting and diarrhea
- Dizzy, confused, agitated or anxious
- Flushed or pale skin
- Tightness in the chest and throat

**Treatment:**

1. Assess response, breathing, circulation and appearance.
2. Activate EMS (call 9-1-1).
3. Assist the victim with use of his or her epinephrine auto-injector if the victim requests help, you are trained and your state and workplace allow it.
4. Reassure the victim.
5. If allergic reaction is from a bee sting, quickly scrape off stinger with a straight-edged object.

## Epinephrine Auto-Injector[8]

People with known allergies may carry an epinephrine kit. Epinephrine is the most commonly used drug for emergency treatment of anaphylaxis (severe allergic reaction), because it quickly relaxes smooth muscles in the lungs to ease breathing, constricts blood vessels and stimulates the heartbeat to maintain blood pressure, and reverses swelling around the face and lips. The sooner it is given, the more effective it is in stopping the reaction. Look for medical alert tags.

The EpiPen® Auto-Injector is an example of a disposable drug delivery system prescribed by a physician and carried by people who have the potential for fatal allergic reactions. The EpiPen® contains a concealed needle that a victim can use to self-administer epinephrine for emergency treatment of a severe allergic reaction. It can be used through clothing or on bare skin. Parents and caregivers of at-risk children should be trained in its use.

**Using an epinephrine auto-injector:**

1. Carefully remove cap and press firmly against the thigh; hold for 10 seconds. Handle carefully.
2. Rub the injection site for about 10 seconds.
3. Go to the nearest hospital emergency department for further care and auto-injector disposal.

# Assessing a Victim

## Overview

Skills in scene and victim assessment could protect the life of both victim and rescuer. Teach students a systematic method with a logical sequence to determine the seriousness of the emergency and what actions to take. There are three parts to a basic first aid assessment.

## Scene Size-Up

The scene size-up is a quick assessment of the scene for hazards, number of victims, determination of what happened (mechanism of injury) and what resources are needed to help. Before taking action, rescuers should size-up the scene.

### Size-up the scene for safety

The very first step in any emergency is to take a look around and check for hazards. Rescuers who are killed or injured only increase the number of victims and amount of confusion at an emergency scene. Rescuers need to make a determination on whether or not it is safe to act. Consider the need for specialized training or equipment. Before approaching the victim assess for: [9,10]

- Fire or danger from explosion and smoke
- Toxic substances, hazardous materials, low oxygen areas
- Vehicles that are unstable or positioned to be hit by other traffic
- Fuel or chemical spill
- Downed power lines, electricity
- Unstable surfaces – slope, water, ice
- Violence, hostile crowds, weapons
- Environmental hazards – rain, swiftly moving or rapidly rising water, extreme heat or cold
- Contagious disease

Even simple clues can be a sign of trouble or an emergency; rescuers should use as many senses as possible when assessing a scene for safety. [11]

**Look:** Stalled vehicles, overturned furniture or potted plant, spilled medicine container, broken glass, smoke/fire, multiple victims

**Listen:** Screams/yelling, moans or calls for help, breaking glass, clashing metal, screeching tires, sudden loud voices, gunshots

**Smell:** Odors that are unrecognized or stronger than usual, burning smell

Exercise caution. Consider the need for specialized rescue training, protection or equipment. If unsure if the scene is safe, do not approach the victim. Instead call 9-1-1 and bring the professionals to the scene.

### Size-up the victims

After confirming the scene is safe, try to determine how many victims, and what has happened to them. Look for more clues at the emergency scene to identify the

potential for serious injury or illness. The clues from an emergency scene may be the only way to piece together what happened.

***Identify the Number of Victims***

Rescuers should identify the number of victims and potential resources. Look carefully for more than one victim. If one victim is bleeding or screaming, you could easily overlook an unresponsive victim, infant or small child.

Consider resources on the scene such as bystanders, first aid kits, personal protective equipment, cell phone, etc. Deploy bystanders to call for help, control bleeding, monitor scene safety, locate friends or family of the victim, get an AED, or just hold someone's hand.

***Mechanism of Injury***

The mechanism of injury is an evaluation of the forces that caused an injury to help you determine the potential for serious injury. [9,12] For example, which mechanism of injury has the greater potential for underlying, life-threatening injuries: a broken arm from a bike fall or a broken arm from a bike vs. car accident? Inspect the scene and gain information from the victim, family or bystanders to determine the mechanism of injury.

A bit of common sense and a sharp eye are needed to help determine the mechanism of injury. Take the following example:

> *There is a car crash involving two vehicles, one large, and one small. The large vehicle has one driver, no passenger and minimal damage to the front fender. The driver is in the vehicle on his cell phone with his seat belt on. The smaller vehicle has severe front-end damage, the windshield is cracked and there appears to be only the driver who is slumped over the wheel bleeding from the forehead.*

Which vehicle appears to have suffered the greatest amount of force from the collision? Is it possible that the cracked windshield has something to do with the head injury? Is there damage to the steering wheel that could indicate serious chest injury or no seat belt? It is easy to determine from the above example which victim has suffered the worst injury and needs your immediate attention.

Suspect serious injury in the following situations:[10]

- Vehicle accidents
- Rollover of vehicle
- Vehicle vs. pedestrian collision
- Ejection from vehicle
- Death in the same vehicle
- Motorcycle or bicycle crash
- Falls greater than standing height

- Explosion or gunshot

Assessing the mechanism of injury provides clues to the rescuer about the cause and potential seriousness of a victim's injuries; it may also be beneficial in determining the presence of internal injuries.[9]

***Nature of Illness***

When the emergency is not injury-related, quickly determine the nature of the illness to identify the potential seriousness and what actions to take. Use the victim, family or bystanders on the scene to help identify the nature of the illness.[9] This may be performed during the Initial Assessment.

Check the scene for clues such as prescription bottles, a medical alert tag, fallen ladder, broken glass, drugs or alcohol. Ask the family about the victim's medical history. A person having shortness of breath may have a history of asthma and may need the rescuer to help locate his or her inhaler.

Unusual appearances or behaviors that may provide insight include: [11]

- Trouble breathing
- Clutching the chest or throat
- Slurred, confused or hesitant speech
- Unexplained confusion or drowsiness
- Sweating for no apparent reason
- Unusual skin color

If the rescuer is unable to determine whether the cause of the emergency is injury-related or medical in nature, he or she should assume the cause is traumatic injury. Support the person in place, assess responsiveness, breathing and circulation, and get help to the scene.

## Activating EMS

When sending a bystander to call 9-1-1, be sure to identify one or two people by name or description (i.e., "You in the blue shirt."). Don't just shout at a crowd to call 9-1-1, because no one may go, or more people than needed may call and tie up dispatchers unnecessarily.

Give the instruction to go call 9-1-1 and come back and let you know it has been done. If the victim is unresponsive, also instruct bystanders to get the AED. If you are alone with an unresponsive adult victim, activate EMS first before beginning care. Situations when EMS should be activated include but are not limited to:[11,13]

- Altered mental status or unresponsiveness
- Difficulty breathing or abnormal breathing
- Chest discomfort
- Severe or uncontrolled bleeding
- Pressure or pain in the abdomen that does not go away

- Severe, persistent vomiting, vomiting blood or passing blood in the stool
- Severe allergic reaction
- Pregnancy emergency
- First time seizure, seizure for more than 5 minutes, or more than one seizure
- Diabetic emergency such as a seizure or strange behavior
- Sudden severe headache, slurred speech, arm or leg weakness, especially on one side of the body
- Head, neck or back injury
- Possible broken bones
- Fall greater than standing height
- Fire or explosion
- Downed electrical wires
- Swiftly moving or rising water
- Presence of poisonous gas
- Vehicle collision
- Victims who cannot be moved easily
- Any time you are not comfortable with a medical or dangerous situation
- Critical burn
- Suspected poisoning

In large buildings or public gathering places it may be helpful to send a bystander to the entrance to guide the EMS personnel more quickly to the scene. Many offices and public venues have prearranged meeting places for the EMS; advise security (or other administration) of the emergency to reduce delay.

Remember to treat the victim in the position found. Only move a victim to provide essential care, or if there is danger to the victim and rescuers. Instruct bystanders not to move the victim.

## Initial Assessment

The initial patient assessment is used once the rescuer is at the victim's side. It is used to assess the **level of response**, identify and treat any **life-threatening conditions**, and determine the victim's **chief complaint**.

### 1. Assess Response

Approach the victim from the side and gather a general impression.

**Unresponsive:** If the victim appears unresponsive, tap the shoulder and shout, "Are you okay?" If there is little or no response, have someone call 9-1-1 (activate EMS), get the first aid kit and AED. Go call yourself if you are alone with an adult victim.

**Responsive:** Introduce yourself, tell the person you are trained in first aid, and ask if you can help. **Ask questions to determine what happened**. What is the chief complaint?

### 2. Assess Breathing

**Unresponsive:** Look up and down the victim for breathing.

- If no breathing or only gasping, begin CPR if you are trained, or chest compressions alone if you are not trained.
- If breathing, continue assessment and closely monitor breathing.

**Responsive:** Check for the **quality**, **rate** and **effort** of breathing.

- Listen for noisy breathing. Is the airway clear?
- Can the person speak?
- Is the victim speaking in broken sentences, or working hard to breathe?

**3. Assess Head-to-Toe**

- Assess circulation and appearance using a systematic head-to-toe approach.
    - Bleeding, skin temperature and color are indicators of circulatory status.
- Look for obvious signs of injury (bleeding, bruising, burns, twisted limbs).
    - Control bleeding with direct pressure.
- Assess appearance
    - Color, sweating, temperature, movement, position
- Treat life-threatening conditions first.
    - Prioritize problems with responsiveness, airway, breathing, and circulation.
    - When you find a life-threatening condition, stop the assessment and give care.

**4. Look for Medical Alert Jewelry**

- If no signs of injury, look for a medical alert tag, bracelet, or shoe tag.
- Might indicate heart condition, diabetes, seizure disorder, asthma, allergy, etc.

If it is unclear whether the victim is injured or ill, treat as an injury. Support the head and neck in the position found by placing your gloved hands at his or her ears while waiting for EMS.[9]

## S: Considerations during an assessment:[15]

- Speak slowly and clearly, but do not exaggerate your speech.
- Make movements slow and deliberate.
- May answer questions slowly; be patient.
    - Medications or fatigue may slow response.
- May be difficult to differentiate between new problem and symptoms from a chronic medical condition.
    - e.g. Is mental confusion from hypoglycemia or from a previous stroke.
    - Interview family members to find out.
- May deny symptoms because does not want to risk losing independence.
    - May not want to be a bother.
    - May not want to go to the hospital.
- If impaired vision and hard of hearing, do not assume the person cannot understand.
    - Talk directly to the person, not the family members.

**Vision**

- Stand where the person can see you**.**
- Stay within view as you ask questions.
- If the person wears glasses, get them for the person.

**Hearing**

- If the person wears hearing aids, get them for the person.
- Turn down background noise (TV, radio, loud talking).
- Speak in lower frequencies.
    - Difficulty hearing high-pitched voices.
    - May understand male voices more easily.
- If cannot hear you, consider writing questions down.

## C: Considerations during an assessment:

- If more than 1 child, Go to the quiet one first. May be unresponsive.
- Get down to child's level.
- Take your time with the assessment.
    - Speak slowly and clearly.
    - Make movements slow and deliberate.
    - Ask a young child to point to where it hurts.

**Involve parents or caregivers**

- Do not separate the child from family or caregiver.
- Give the parent a task to perform.
    - Apply pressure on a bleeding wound.
    - Hold the child.
    - Call 9-1-1.
- Ask for help reassuring a frightened child
- Ask about a child's medical history.

**After the emergency:**

- Notify child's parents or legal guardian of the emergency.
- Complete any required paperwork at school or childcare facility.
- Talk with other children who witnessed the emergency.

***Infants: The most difficult to assess, because they cannot communicate verbally.***

- Be alert for signs of listlessness or exhaustion, which indicate severe distress.
- Support the head of infants younger than 4 months.

***Age 1-5: Easily scared by strangers.***

- Do not remove clothing, and avoid any unnecessary touching.
- Use observation to help your assessment.

***Age 6-12: When injured or stressed, may behave younger than their actual age.***

- Be honest if something is going to hurt.
- Work slowly, avoiding any surprises.
- Give a simple explanation of what you are going to do.

**Determine the Chief Complaint**[10]

During the initial assessment the first aid responder will ask an alert victim questions to find out what is bothering the person the most. It is the first piece of information you need to obtain, and should be summed up in a few words (e.g. “squeezing in my chest” or “twisted ankle”). In a situation in which injuries are obvious to the rescuer (e.g. falling off a ladder), it is still useful to determine the chief complaint. Finding out what is bothering the victim the most may lead the rescuer to unexpected or unnoticed injuries.

The chief complaint is best obtained by asking open-ended questions like, “What seems to be troubling you?” (illness) or “What is bothering you the most?” (injury). Remember, if you don’t ask, you won’t find out.

**Assess Appearance**

During the head-to-toe assessment, the rescuer will use skin signs to help determine the seriousness of the victim’s condition. Assessment begins the moment that you first see and touch the person. Assess the skin for color, temperature and moisture.

***Skin Color***[10]

The color of the skin, especially in fair patients, reflects the underlying circulation as well as the oxygen saturation of the blood. When the blood vessels are doing a good job of supplying the tissues with oxygen, skin signs are warm and pink. For those with darker pigmentation, assess the mucous membranes (e.g. inside the lip) or at nail beds.

Abnormal skin colors and possible causes:

- **Red:** Fever, allergic reaction, carbon monoxide poisoning
- **White** (pallor/pale): Excessive blood loss, fright, cold, shock
- **Blue:** Low blood oxygen level, shock, cold
- **Mottled** (a mix of white, gray and red): Shock

***Skin Temperature & Moisture***[119]

Normal skin temperature is warm and dry. Skin temperature rises from fever, high environmental temperatures, and certain medical conditions (e.g. anaphylactic shock, heat stroke). Shock or severe stress can cause the body to sweat, or become moist; dehydration and injury to the thoracic or lumbar spine can cause the skin to be dry.

Abnormal skin temperature and possible causes:

- **Hot, dry:** Excessive body heat (i.e. heat stroke)
- **Hot, wet:** Reaction to increased internal or external temperature
- **Cool, dry:** Exposure to cold
- **Cool, clammy:** Shock

***To Assess Skin Signs***

Place your forearm or the back of your gloved hand against the patient's forehead. Hold your hand there for several seconds. Assess for temperature, color and moisture of the skin. It can be helpful to assess the skins signs of the core (chest) against the skin signs of the extremities (arms and legs) for differences. Cooler, paler extremities, when compared with the skin signs of the core, are a sign of shock.

## On-Going Assessment

After EMS has been activated and the initial assessment is completed, treat any signs and symptoms or injuries according to need. Perform an on-going assessment to update the status of the scene and your victim while you wait for professional responders to arrive:

1. Ensure the scene is still safe.
2. Reassess and continually monitor responsiveness and breathing.
3. Observe for changes in the mental status of the patient (i.e. becomes confused or unresponsive).
4. Repeat initial assessment as needed.
5. Ensure treatments are effective.
6. Protect the victim from the elements.
7. Calm and reassure the victim.

**Activities: Demonstrate and Practice Assessing a Victim**

Demonstrate the skill of assessing a victim to your students. Students are required to practice before being tested on the skill.

***Demonstration: Assessing a Victim***

1. Select a volunteer.
2. Perform an Initial Assessment on the student volunteer.
    a. Assess response, assess breathing, Assess head-to-toe for injury and appearance, look for medical alert jewelry.
    b. Ask the victim what is wrong.

***Student Practice of Assessing a Victim:***

1. Pair up the students.
2. Instruct one student to perform an Initial Assessment on the other student.
    a. Assess response, assess breathing, Assess head-to-toe for injury and appearance, look for medical alert jewelry.
    b. Ask the victim what is wrong.

# Bites and Stings

## Animal Bites[16,17,18,19]

Millions of Americans each year are bitten by animals, including cats, mice, rats, birds, and occasionally horses, cows and pigs. Wild animal bites are rare. Dogs, however, are responsible for about 80% of all animal bites.

There are about 77.5 million domesticated dogs in the U.S. Almost 40% of U.S. households has a dog as a pet. The family dog is responsible for half of all dog bites. Dogs bite more than 4.7 million people each year; 2.8 million (60%) of the dog bite victims are children. Children between the ages of five and nine have the highest injury rates.

Approximately 800,000 dog bite victims seek medical attention each year, with an estimated 368,000 of them treated in emergency departments. About a dozen victims die each year from dog bites. Unneutered male dogs are involved in over 90% of reported dog bite cases. Most victims know the dog that bites them.[2]

Bites may produce slight bruising or large complex lacerations. The biggest concerns with animal bites are bleeding and the possibility of infection. Deep animal bites, such as those of a cat, are at highest risk for infection. Rabies and tetanus are the biggest concern because there is no cure; immediate treatment is critical.

**Rabies** is a viral disease found in mammals that is usually transmitted through the bite of a rabid animal. Bites from wild animals or non-immunized domestic pets carry the risk of rabies. If a victim is bitten by a wild animal or unknown pet, notify animal control personnel to request help in capturing it. A bite from a skunk, raccoon, bat, fox, or another mammal that is unprovoked or behaving strangely is treated as a rabies exposure.

Rabies vaccinations are important for the protection of humans and domestic animals. The primary risk to humans is that a rabid wild animal may pass the infection on to a domestic animal or a human. Vaccinations have significantly reduced confirmed incidents of rabies in domestic dogs. There are only 1 or 2 cases of rabies in humans each year. Rabies, when left untreated, is almost always fatal.[20,21]

**Tetanus**, also known as lockjaw, is contracted when a cut or wound is contaminated with the tetanus bacteria. It is found in the environment throughout the world, commonly in soil, dust and manure. Tetanus causes such severe muscle spasms that the person can no longer open his or her mouth. Approximately 10% of reported cases are fatal. It is contracted through cuts or wounds, especially deep puncture wounds such as those made by knives or nails. It is important to follow current

medical guidelines for tetanus vaccination and boosters. Always contact your physician to determine if a tetanus vaccination is required after an animal bite.[22]

**Dog Bite Prevention**[17,18,19]

Dogs may bite while protecting their owners and territory. They are also likely to bite when in pain, while eating, or when they feel threatened. Regardless of size, breed or personality, all dogs can bite if provoked.

The great majority of dog bites are preventable. In order to reduce the number of dog bites, it is necessary to educate people, especially children, about bite prevention, and teach dog owners about responsible pet ownership.

***Dog Bite Prevention Tips:***

- If approached by a dog, stand still while it sniffs you and determines you are not a threat.
- If threatened by a dog, remain calm and avoid eye contact. Do not run. Stay still until the dog leaves, or slowly back away until the dog is out of sight.
- Teach children not to annoy or tease animals.
- Be wary of moms with pups.
- Do not approach an unknown animal.
- Do not disturb an eating or sleeping dog.
- Do not leave young children or strangers with a dog.
- Do not attempt to break up a dogfight.
- Ask permission from a dog's owner before petting it.
- If knocked down by a dog, curl into a ball, protect your face and lie still.
- Keep pets on a leash when out in public.
- Neuter male dogs, since un-neutered male dogs bite most often.
- Train your dog to obey basic commands.

**Signs and Symptoms:**

- Skin break with or without bleeding (abrasions, lacerations, punctures, tissue loss or avulsion)
- Bruising
- Pain
- Bite marks
- Crush injuries, fractures
- If infected, increased pain, redness, swelling, drainage, fever

**Treatment:**

1. Ensure scene safety. Do not touch or try to capture a potentially rabid animal yourself.
2. Ask a bystander to call 9-1-1 and get a first aid kit.
3. Assess response, breathing, circulation and appearance.
4. Wash wound immediately under pressure for several minutes with soap and water. Irrigation has been shown to reduce the risk of rabies or bacterial infection.[23]
5. Control bleeding with direct pressure.

6. Apply antibiotic ointment and cover with a sterile dressing.
7. Seek medical care for further wound cleaning, sutures or vaccine, especially for bites to the face, neck or hands, deep puncture wounds or large lacerations.
8. Report bites to a police or animal control officer.

Seek medical care for bites to the face, neck or hands, deep puncture wounds or large lacerations. Contact your doctor for evaluation if you have cancer, AIDS, diabetes, liver or lung disease, or another condition that might weaken your ability to fight infection. If your last tetanus shot was more than five years ago, you may need a booster shot. Report any flu-like symptoms following an animal bite. All human bites that break the skin should be treated with antibiotics.

If you are bitten by a domestic animal that appears healthy, the owner should confine it for 10 days and observe it for illness. If you are bitten by an animal that appears ill or becomes ill during the 10-day confinement, have it evaluated by a veterinarian for rabies and seek medical care immediately for possible vaccination.

**Human bites** can be as dangerous as or more so than animal bites because of the risk of infection from the bacteria and viruses contained in the human mouth. Most human bites cause only a bruise or shallow laceration, because human teeth are not very sharp. Human bites may occur when very young children are playing or fighting, when trying to restrain a child, in mental institutions, in prisons, or self-inflicted during thumb sucking or nail biting.

When someone accidentally cuts his or her knuckles on someone else's teeth, such as might happen during a fight or a sports activity, it is also considered a human bite. The "fight bite" frequently becomes infected, and may lacerate the finger tendon that crosses over the knuckle. A physician should always evaluate human bites.

## Snakebites[23,24,25]

There are about 7,000-8,000 venomous snakebites each year in the US; about 5 of those people die. Snakebites can be painful, but are rarely fatal. Most snakes are not poisonous. There are four types of poisonous snake found in the US: the rattlesnake, the coral snake, the water moccasin, and the copperhead. Rattlesnakes create a rattling sound by shaking the rings at the end of their tail. Coral snakes have yellow, red and black rings along their bodies. Water moccasins, also known as cottonmouths, have a white, cottony lining in their mouth. Copperheads have a copper-colored head and a reddish-brown hourglass pattern on the body.

Rattlesnakes are responsible for most poisonous snakebites in the U.S. The amount of venom delivered by a poisonous snake will vary according to its size, age, the timing of the bite, and how well it was able to sink its fangs into a victim. If venom is injected during a poisonous snakebite, signs and symptoms of envenomation will

usually appear within the first hour. The symptoms vary greatly, depending on the size, species and age of the snake, along with the location of the bite, the victim's age and health.

**Signs and Symptoms:**

- Fang marks (2 small puncture wounds)
- Burning pain
- Rapid swelling within minutes
- Bruising, necrosis (tissue turns black and dies)
- Tachycardia (rapid heart rate), low blood pressure
- Bloody wound discharge
- Diarrhea
- Convulsions, fainting, dizziness
- Weakness, loss of coordination
- Blurred vision
- Excessive sweating, fever
- Numbness and tingling
- Nausea and vomiting
- Increased thirst

**Treatment:**

1. Scene safety.
2. Call 9-1-1 to get medical help immediately. Antivenom must be given soon after the bite.
3. Keep the victim calm and still, with the bite area lower than the heart.
4. Wash the wound gently with soap and running water.
5. Remove jewelry and constrictive clothing; swelling can progress rapidly.
6. Wrap an elastic bandage around the entire bitten arm or leg, starting furthest from the heart. Use overlapping turns to wrap snugly, but still allow a finger to slip under the bandage. Check temperature and sensation below the wrap to make sure it is not too tight.
7. Mark the border of the swelling/redness every 15 minutes with a pen.

**Do not** apply a tourniquet.
**Do not** cut the wound or apply suction or local electric shock.
**Do not** apply ice.
**Do not** try to capture the snake.

All snakes should be shown respect and treated as poisonous until proven otherwise. Do not play with or pick up a snake unless you are properly trained. When hiking, remain on marked paths. Keep your hands and feet out of areas you cannot visualize. Be cautious when picking up rocks or firewood.

Even nonpoisonous snakebites can cause infection or allergic reaction in certain people. If bitten, consult a physician about the need for a tetanus shot.

## Spider Bites and Scorpion Stings[26,27,28,29,30]

There are more than 50,000 species of spiders. Although they are beneficial to the environment, they are often killed by humans out of fear, not because they pose an actual danger. Spiders usually prefer to live in undisturbed areas, such as the corners of a house or in a garden. When they bite, it is usually out of fear as they are trying to defend themselves. Spiders generally bite only once, so if a victim has multiple bites, it is usually from an insect such as a flea or bedbug.

In the U.S., spider bites and scorpion stings are rare. Most spider bites are harmless to humans because their fangs are too short or fragile to penetrate human skin. All spiders carry some type of venom. Only two spiders (the brown recluse and the black widow) and one scorpion (the bark scorpion) pose a danger to humans. Those most at risk include the very young and very old, those with cardiovascular disease, and people who tend to have allergic reactions.

The **black widow** measures ½ to 1 inch in length, and is shiny black. It is identified by the red or orange hourglass-shaped mark on its abdomen. Only the female is dangerous to humans. The black widow spider is found in dark and damp places throughout most of the Western hemisphere. Their venom is a neurotoxin, so it affects the nervous system. Symptoms vary greatly, but may include immediate pain, cramping and muscle rigidity. Death is rare; exceptions may be young children, the elderly, and those with cardiovascular disease.

The **brown recluse**, also known as the **fiddleback**, or violin spider, is about ½ to 1 inch long and is identified by its light brown color and dark brown fiddle-shaped mark on its upper back. These spiders live in the mid-South and lower Midwest. They hide in dark, quiet, cool places that are out-of-the-way, like boxes, closets, basements, and garages. Their bite is initially mild and often goes unnoticed. Symptoms will develop hours or days later. Pain will usually start one to eight hours later at the site of the bite. After one to two days, a generalized rash may develop. Within two to three days, the venom causes local tissue destruction, often resulting in a blister surrounded by bruising or a red ring, then a white ring (bull's-eye effect). The blister may fill with blood, then rupture and form an open wound.

**Scorpions** in the U.S. are found mostly in the southwest United States. Most are relatively harmless. Only the bark scorpion, which is found primarily in Arizona, New Mexico and on the California side of the Colorado River, is dangerous to humans. Scorpions are characterized by an elongated body and a segmented tail. It is the tail that contains the telson in which venom is produced and stored, and the stinger that injects the venom.

Scorpions usually only sting when provoked or in self-defense. They are not aggressive creatures. There seems to be an increase in stings in the cool evening and night hours, when the nocturnal scorpion is out hunting for prey. Common symptoms include pain, numbness and tingling at the site. Serious symptoms may

include difficulty breathing, muscle twitching, abnormal head, eye and neck movements, increased salivation, sweating and restlessness. Children under 10 and the elderly are more at risk to develop serious symptoms.

**Signs and Symptoms:**

- Immediate severe pain, burning
- Redness, swelling, rash, itching
- Two small puncture wounds
- A blister or ulcer that may turn black
- Headache, dizziness, weakness
- Elevated heart rate & blood pressure
- Sweating, fever, cramps
- Nausea, vomiting, salivation
- Respiratory distress
- Anxiety
- Unresponsiveness

**Treatment:**

1. Call 9-1-1 (activate EMS) for suspected bite from a black widow, brown recluse, scorpion, or if any life-threatening signs are present.
2. Wash the wound with soap and running water. Apply antibiotic ointment if no allergy.
3. Apply an ice pack wrapped in a moist cloth.

***Tips:***

- Destroy webs with a stick or broom.
- Check for spiders or insects before reaching into boxes or donning gloves, shoes or articles of clothing that are lying on the floor or in a closet.
- Watch out for dark hiding places indoors.
- Clear shrubbery, logs and trash from around the home.
- Keep window screens in good repair; seal cracks and crevices leading into the home.

## Tick Bites:[31,32]

Ticks are related to spiders and scorpions, and attach themselves to the skin of animals or reptiles to suck their blood. Although most tick bites are harmless, some species can transmit life-threatening diseases. Two common types of ticks are the deer tick and the dog tick. The deer tick is found in many parts of the U.S. Those found in New England and parts of the Midwest are more likely to carry Lyme disease than those found in other areas. The dog tick, which is very common, may carry a disease called Rocky Mountain Spotted Fever.

The risk of disease transmission increases after 24 hours, so it is important to remove a tick as soon as possible after discovery. Their bite is painless, so it is necessary to check your skin and clothing for ticks when coming indoors. Check for ticks on parts of the body that bend (underarms, knees, between fingers and toes),

on top of the head, behind the ears, on the neck and hairline, where clothing presses on the skin (collar, wrists, ankles, waist, top of legs).

Ticks can be found in the woods, shrubbery, high grasses, gardens, marshes and beach areas. When in areas known to have ticks, wear light-colored clothing (for easier tick identification), a long-sleeved shirt with tight cuffs, long pants tucked into socks, and a hat. Use repellant to prevent tick bites. Consult your physician about the Lyme disease vaccine.

**Tick Removal & Treatment:**

1. Remove as soon as possible.
2. Use curved tweezers to grasp close to the skin.
3. Lift the tick straight out firmly and steadily without twisting or pinching until it lets go.
4. Save the tick for testing if needed in a sealable container.
5. Wash the site with soap and water. Swab the skin with alcohol, and apply an antibiotic ointment if no allergy.
6. Seek medical care if you cannot remove the tick completely, or if a rash or flu-like symptoms develop.
7. High-risk patients (pregnant, or living in areas endemic to tick-borne disease) should consult with their physician as to the need for antibiotics.

**Do not** crush or squeeze the tick's body while removing it. The tick's potentially infectious body fluids may escape.
**Do not** use petroleum jelly, alcohol, or a hot match to kill the tick before removal. These techniques may induce the tick to expel infected saliva into the bite site.
**Do not** handle the tick with your bare hands.

## Insect Stings[33,34]

Insect stings can cause pain, swelling and allergic reactions, but are rarely serious. Common biting insects include sand flies, horseflies, deerflies, mosquitoes, fleas, lice, bedbugs, kissing bugs, fire ants and some water bugs. The reaction is usually mild, resulting in a small, red, swollen, itchy area. Sometimes the sting area can get infected, or more rarely, the victim has an allergic reaction. If a stinging victim develops serious symptoms (breathing difficulties; severe swelling, especially around the face; hives; nausea; dizziness), get emergency medical help immediately. A single sting of a person who is severely allergic can be fatal.

Most severe sting reactions are caused by honeybees, yellow jackets, hornets, paper wasps and fire ants. Thousands of people are stung each year.

These insects have venom in a sac attached to their stinging mechanism. The venom is released into the body through a hollow conduit (stinger). A person who is allergic to insect stings has an immune system that overreacts to the venom. After the first sting, the victim's body produces antibodies that, along with many other

substances, circulate throughout the body. When the venom from a subsequent sting enters the body, antibodies work to fight off the venom (antigen). This conflict results in the release of histamine and other chemicals that cause allergic symptoms. People who are highly allergic to stings should carry an emergency epinephrine auto-injector at all times and consider wearing a medical ID bracelet or necklace stating their allergy.

Most honeybees will leave their barbed stinger, with the venom sac or pouch attached, in the victim's skin. The bee dies as a result of this. Hornets, yellow jackets and wasps do not usually leave their stingers. If stung by a bee, quickly place your fingernail or a straight-edged object (e.g. credit card) at the base of the stinger and scrape it off. The speed of your response is most important, because 90% of the venom is delivered within the first 20 seconds. Do not pull the stinger out with your fingers or tweezers, if possible, because you might squeeze the venom sac, causing even more venom to be released.

**Signs and Symptoms – Mild:**

- Redness and swelling at site
- Localized burning and itching
- Blister formation about 24 hours after the sting (fire ant)

**Treatment – Mild Reaction:**

1. Move to a safe location to avoid more stings.
2. Remove the stinger quickly by scraping it off with your fingernail or a straight-edged object.
3. Wash the area with soap and water.
4. Apply an ice pack wrapped in a moist cloth to reduce pain and swelling.
5. Consider an over-the-counter antihistamine, analgesic and corticosteroid to relieve itching, pain and inflammation. Contact your physician for further instructions.
6. See your physician if the swollen area is large, if the sting site is in the mouth or nose, or if you develop delayed reactions such as mild nausea, intestinal cramps or diarrhea.

**Signs and Symptoms – Severe (Anaphylaxis):**

- Difficulty breathing or wheezing
- Hives and rash
- Dizziness, faintness
- Shock (very low blood pressure, rapid heart rate)
- Difficulty swallowing
- Facial, throat or tongue swelling
- Stomach cramps, nausea or diarrhea

**Treatment – Severe Reaction:**

1. Assess response, breathing, circulation and appearance.
2. Activate EMS (call 9-1-1).

3. If victim is carrying an epinephrine auto-injector, help to administer it if you are asked, and if state and local regulations allow.
a. Remove the stinger quickly by scraping it off with your fingernail or a straight-edged object.
4. Observe for signs of shock; treat as indicated.

***Tips to Avoid Insect Stings:***

- Avoid stinging insects' nests. Most insects will not attack if left alone.
- Hire a trained exterminator to clear hives and nests from around your residence.
- When you encounter a flying insect, remain calm and quiet, and move slowly away. Do not swat at an insect, as this may cause it to sting.
- Avoid brightly colored clothing and perfume, perfumed soaps, shampoos and deodorants when outdoors, so that you don't resemble or smell like a flower.
- Avoid flowering plants.
- Be careful when eating, cooking or drinking outdoors. The smell of food attracts insects.
- Wear closed-toed shoes outdoors.
- Keep outdoor eating areas and grills clean. Keep lids on trashcans.

## Marine Animal Stings[23,35]

**Coelenterates**, which include **jellyfish**, **corals**, **sea anemones** and the **Portuguese man-of-war**, have tentacles, which are the firing mechanism of the sting. The nematocysts (stinging units) on the tentacles are the animal's defense tool for protection. They continue to function even long after the animal is dead.

Most coelenterate stings only require cleaning. The stinging sensation will go away usually in one hour. Stings from the Portuguese man-of-war have been known to cause death. Stings may also result in anaphylactic shock, which is life-threatening.

**Signs and Symptoms:**

- Pain, redness, hives/bumps/rash. The rash may develop into blisters, fill with pus and then rupture.
- Nausea, weakness, headache
- Muscle pain and spasms
- Runny eyes and nose
- Fever, chills, sweating
- Severe reactions may include chest pain, difficulty breathing, coma and death.

**Treatment:**

1. Assess response, breathing, circulation and appearance for more serious reactions.
2. For Box Jellyfish stings, wash liberally with vinegar as soon as possible for at least 30 seconds. This will inactivate the nematocysts so they can't release venom. If vinegar is not available, use a baking soda slurry.
3. Remove tentacles with tweezers or a gloved hand.
4. After the nematocysts are deactivated, immerse in hot water for at least 20 minutes to decrease the pain.

5. Seek medical treatment immediately for severe reactions.

**Stingrays** are very hard to see and are found in the ocean under sand as they try to hide due to their cautious nature. Normally non-aggressive, the rays are found in the U.S. on both the East and West Coast, in the Sea of Cortez and the Gulf of Mexico. When a person steps on a stingray, it thrusts its tail spine into the victim's foot or leg and releases venom.

It should be noted that not all rays have a cartilage-like barb under the tail section. This is strictly for protection and varies with species. Swimmers are encouraged to wear water socks or other protective footwear when in ray habitat, and to shuffle their feet to warn the creatures of approach.

**Signs and Symptoms:**

- Jagged, freely bleeding wound
- Immediate painful or throbbing sensation, redness, swelling
- Weakness, nausea, anxiety, fainting
- Less common symptoms include vomiting, diarrhea, sweating, cramps, difficulty breathing

**Treatment:**

1. Remove person from water/environment.
2. Remove barb if it is superficial and not penetrating the chest, neck, or abdomen.
3. Apply firm direct pressure with sterile gauze to control bleeding.
4. See a physician to clean the wound and remove any remaining fragments of the spine. Stitches may be required.

The **sculpin** is a fish that is found in many areas throughout the world. It has poisonous/venomous fin tips. Thick leather gloves or cutting the fishing line as close to the fish as possible and releasing it are two methods for dealing with this creature. Generally, most of these injuries are non-emergent and seldom require a physician's care.

**Signs and Symptoms:**

- Redness
- Burning sensation
- Localized swelling

**Treatment:**

1. Immerse in hot water at least 110-115° F for 60-90 minutes.
2. Appropriate wound care.

# Bleeding

## Overview[14]

Blood is a fluid that is made up of the following:

- Red blood cells (carry oxygen and give color to blood)
- White blood cells (attack foreign bodies and protect against infection)
- Platelets (assist in blood clotting)
- Plasma (a pale yellow liquid that carries nutrients)

Blood travels through the body in three types of vessels:

- Arteries (carry blood away from the heart)
- Veins (carry blood to the heart)
- Capillaries (very small blood vessels that carry blood throughout the body).

The human body contains an average of 10 pints of blood. Most people can lose one pint of blood (the amount given for a blood donation) without any harmful effects. If a victim loses two pints of blood, he or she may go into shock. The loss of five to six pints will usually result in death. Children and the elderly have less tolerance for blood loss, and may go into hypovolemic shock sooner than a non-elderly adult. Control of severe bleeding by a bystander is a critical treatment that can truly save a life.

## Types of Bleeding:

Bleeding is the body's way of cleansing a wound and minimizing the chance of infection. A damaged blood vessel will constrict and stop bleeding when the body produces a blood clot that plugs the damaged area. Many minor wounds will actually stop bleeding without intervention; the first responder is simply helping with the process. Severe, uncontrolled bleeding, however, is life threatening.

Direct pressure on the wound will control most bleeding. This is the primary first aid treatment for bleeding control, and has been validated through extensive research. Apply firm, direct pressure until the bleeding has stopped completely or trained rescuers arrive.

**There are three types of bleeding:**

- **Arterial:** Bright red blood spurting from the wound. The spurting coincides with the beat of the heart.
- **Venous:** Dark red blood flowing steadily from the wound. There may be a lot of bleeding due to the large size of some veins.
- **Capillary:** Blood slowly draining or oozing from the wound.

Arterial bleeding is the most serious type of bleeding due to the amount and speed of blood loss. It is also the hardest type to control because of the higher pressure in the arteries.

Note: A scalp or facial wound may be small but bleed freely due to the location and number of blood vessels under the skin.

## Types of Wounds:

- **Incision:** A clean break of the skin usually made with a sharp object (e.g. sharp knife).
- **Laceration**: A wound that is torn rather than cut. The wound is usually made by a dull or blunt object (e.g. dull knife, machinery accident, piece of glass), so the wound edges may be irregular.
- **Puncture Wound:** Usually a deep wound with minimal bleeding (e.g. nail, animal bite). Has the greatest chance of infection. Deep puncture wounds may cause internal bleeding.
- **Abrasion:** A scraping away of skin that is usually painful because many nerve endings are involved. Common examples include skinned knees and rope burns. Remove all embedded foreign particles that could cause infection or "tattooing" of the wound.
- **Avulsion:** A tearing injury in which a piece of skin or other tissue is completely or partially torn from the body. There is usually severe bleeding.
    - Fold or replace torn skin if possible.
    - Wrap the wound as a laceration.
    - If the skin or tissue is completely torn from the body, salvage it as an amputated part.
    - A **skin tear** is a tearing away of the skin from the tissue below. Treat it as an avulsion.
- **Amputation:** Loss of body part. (See Traumatic Injuries for more information)

Note: An abdominal wound may expose internal organs, such as bowels, and even result in their protrusion through the wound. Do not attempt to push extruded organs back into the wound. Cover them with moistened gauze or cloth, and avoid excessive pressure.[37]

### Severe Bleeding Treatment[36,37]

Do not attempt to clean the wound at this time. The priority is to stop the bleeding.

1. Call 9-1-1 if bleeding is severe, does not stop, there are signs of internal bleeding or shock, or there is an impaled object.
2. Universal Precautions (gloves, mask, goggles, hand washing)
3. Assess response, breathing, circulation and appearance.
4. Lay the victim down. This will reduce the chance of fainting. Calm and reassure the victim.
5. Remove any clothing over the wound so you can see where the bleeding is coming from.
6. Apply steady, direct pressure. Use a gloved hand and the cleanest available layered gauze or folded cloth. Add dressings as they become soaked with blood; do not remove them, as this will disrupt the clot formation.

7. Release the pressure slowly and observe for bleeding. Severe bleeding may take more than 10 minutes of continuous direct pressure to control. If the bleeding does not slow or stop, make sure you are applying pressure precisely over the wound.
8. Treat for shock – elevate legs and maintain body temperature.
9. After bleeding has stopped, consider the use of a pressure dressing to maintain pressure, especially if you are the only rescuer and you must leave to get help. Apply a roller or elastic bandage firmly around the wound to help control bleeding.
10. If help is delayed, splint an extremity with a severe wound to prevent movement that could restart bleeding.
11. Check regularly to make sure that swelling has not made the dressings too tight.

**Do not** peek after a few minutes to see if the bleeding has stopped. This could interfere with clot formation and prolong the bleeding.

**Do not** remove any deeply embedded objects, or attempt to clean the wound at this time. The priority is to stop the bleeding.

**Do not** apply pressure to the carotid artery (neck).

TIP: Pack a large, open wound with sterile gauze before applying direct pressure.

Follow up with a physician for further care if:

a. The wound may require stitching (is more than ½" long or has gaping wound edges).
b. The wound is large or deep.
c. Dirt or debris remains in the wound.
d. Tetanus shot is needed. Get a tetanus shot within 48 hours of the injury if you haven't had one in the past 5 years.
e. The wound is from a human or animal bite, puncture, burn, electrical or chemical injury.
f. High risk or signs of infection (redness, warmth, increased pain, pus or cloudy discharge, swelling, fever).
g. The wound is on the head, face or neck.

**Tetanus**, also known as lockjaw, is an infection of the nervous system caused by common bacteria that live in the soil. Although it is serious and sometimes fatal, it is completely preventable through vaccination. Tetanus signs and symptoms include painful muscle spasms of the jaw and upper body, drooling, sweating, fever, hand or foot spasms, difficulty swallowing, irritability, and incontinence. Treatment may involve medication, bedrest, and surgery.

If someone has an open wound and has not had a tetanus booster in the past 5 years, he or she should get one, especially if the injury was exposed to soil or sustained outdoors.[22]

Note: Previously, rescuers were taught to use elevation and pressure points to control severe bleeding. These techniques are no longer recommended because

there are other methods that have been proven more effective. The primary method to control bleeding is direct pressure; the use of elevation and pressure points may actually be harmful by interfering with the application of direct pressure.[23]

**Minor Wound Treatment and Bandaging**[23,40,41,42]

After bleeding is controlled, the goals of wound care are to reduce the risk of infection, control pain, and promote healing. Use the cleanest dressing materials available, sterile if possible. Open packages and handle dressings carefully to keep them as clean as possible.

1. Wear personal protective equipment. Wash your hands before and after wound care.
2. Stop the bleeding with direct pressure. Minor bleeding may take only 2-5 minutes to control.
3. Clean the wound. Rinse thoroughly with clean water with or without soap. Do not use alcohol, hydrogen peroxide or iodine-containing cleansers directly in the wound, because they damage living cells and can delay healing.
4. Apply an antibiotic ointment (preferably a triple antibiotic ointment) to a superficial injury or abrasion to keep the wound bed moist and reduce the risk of infection. Ensure there is no history of allergy to the antibiotic ointment.
5. Cover the wound with a bandage to help keep it clean.
    a. Control bleeding completely before you apply a bandage.
    b. If an absorbent dressing is needed, apply sterile gauze directly over the wound to keep it clean and absorb blood and wound drainage. Apply adequate layers of gauze so that there is no strike-through of blood or wound fluids through the outer layer of gauze. Secure with roll gauze or adhesive tape, depending on the wound location.
    c. If there is a concern that the dressing may stick to a wound, apply a non-adherent pad covered with gauze layers to the wound. This will allow dressing changes without damaging the healing tissue and causing fresh bleeding. Secure with roll gauze or adhesive tape, depending on the wound location.
    d. If there is minimal or no bleeding or drainage from the wound, apply an adhesive bandage (e.g. band-aid).
    e. Change the dressing daily, or if it gets wet or dirty.
6. Watch for signs of infection (redness, warmth, increased pain, pus, swelling, fever).
7. Watch for possible allergy to adhesive tape or antibiotic ointment. (e.g. redness, rash, hives, pain, etc.)

NOTE: A victim who has a bleeding disorder or is taking anti-clotting medication may take much longer to stop bleeding.

**Skin Tears**[38,39]

A skin tear is a common type of wound in older persons due to the thinning of the skin and the decrease in moisture, strength and elasticity with age. Some medications may also cause the skin to become thinner, increasing susceptibility to tears. They occur most commonly on the hands, arms and lower legs as a result of a bump, fall, or even vigorous washing and drying of skin.

Risk factors include impaired vision, use of corticosteroids, malnutrition, dementia, limited mobility, loss of pain perception.

Prevent skin tears when possible.

- Create a safe environment: keep your home well lit; arrange furniture and clear pathways to allow adequate space to walk without bumping furniture; have a nightlight.
- Protect yourself: wear long sleeves or pants; drink fluids between meals; eat a healthy diet; use lotion on dry skin.
- Consult a specialist: ask your doctor if your medications could contribute to skin tears; talk to a nutritionist.
- Train caregivers: use appropriate equipment to avoid friction or shearing when positioning or transferring a patient (e.g. use transfer belt and draw sheet); provide adequate fluids and nutrition; apply lotion to dry skin; use non-adherent dressings on fragile skin, and secure with paper tape, gauze wraps or stockinettes.

**Pressure Dressings**

If the wound continues to seep after applying direct pressure, consider the use of a pressure dressing. Pressure dressings should only be used on an extremity wound. They need to be monitored closely to ensure adequate blood flow beyond the wound so that a tourniquet effect is not created.

When applying a pressure dressing remember that the innermost wound dressing should never be removed. Apply additional dressings and bandages over the original ones.

To create a pressure dressing, place a large wad of folded material over the original wound covering, then secure it in place with an elastic bandage, roller gauze, a triangular bandage, or strips of torn cloth.

**To Apply a Pressure Dressing:**

1. Ensure adequate circulation below the level of the wound (i.e. to the foot or hand).
2. Apply a wad of the cleanest available folded material such as gauze, a triangular bandage or any pieces of folded cloth directly over the wound.
3. Prepare an outer bandage such as roller gauze, a triangular bandage, handkerchief, sock, strip of torn shirt or any other similar material and fold it into a long strip. Do not use narrow material such as shoestrings, as they could damage the blood vessels and create a tourniquet effect.

4. Place the bandage directly over the wad of folded cloth. Secure the bandage in place by rolling it over the wound and tying a non-slip knot in place directly over the wound. An elastic bandage may also be firmly wrapped over the wound, but not too tightly.
5. Check the person's sensation, skin color, temperature and motion below the wound periodically (every 5 to 15 minutes). Ensure there is no numbness or tingling beyond the dressing. Loosen the pressure dressing as needed to ensure adequate circulation below the wound.

**Tourniquets**[23,43]

Apply a tourniquet only if the victim has severe bleeding that cannot be controlled by direct pressure and is in danger of bleeding to death. The use of a tourniquet can damage nerves and blood vessels and can lead to the loss of an arm or leg, as well as systemic complications and even death. These complications are associated with duration of application and amount of pressure. A tourniquet may be used by first aid providers if properly trained and only in certain circumstances, such as when EMS responders are delayed. Further research is needed to identify the best design, application and conditions for their use.

**Tourniquet Application**

Use only if the victim has severe, uncontrolled, life-threatening bleeding from an arm or leg. The rescuer is making a decision to risk losing the limb to save a life.

1. Apply a tourniquet to the limb between the site of bleeding and the heart, about 2 inches above the wound.
    a. By placing the tourniquet close to the wound, more viable tissue can be preserved above the tourniquet.
    b. Do not apply the tourniquet over a joint or on the wound.
    c. Use a commercial tourniquet, if available.
    d. If a commercial tourniquet is not available, make a tourniquet using a bandage at least 1" wide and 4 – 6 layers thick and wrapping it several times around the limb. (Do not use a cord or string, because it will cut through the skin.) Tie a square knot, place a stick over the knot, and tie the stick in place with the loose ends of the bandage.
2. Tighten just to the point that bleeding is stopped.
    a. Twist the stick, or tighten the device.
3. Secure the device or tightening stick in place with tape or another bandage.
4. Record the time of application. Write it on the tourniquet.
5. DO NOT cover the tourniquet with a bandage or clothing. Keep it in sight so that rescuers remember that it is there.
6. Ensure that EMS is activated.
7. Inform professional rescuers of the time the tourniquet was applied.
8. DO NOT remove a tourniquet unless you are directed to by medical professionals or local protocol. Allow advanced medical professionals to remove it.

Follow local protocols for tourniquet application. Follow manufacturer's directions for use of a commercial tourniquet.

**Topical Hemostatic Agents**[23]

Hemostatic Agents are designed to control severe external bleeding by assisting with clot formation. They are not recommended for routine use by first aid providers at this time "…because of significant variation in effectiveness by different agents and their potential for adverse effects, including tissue destruction with induction of a proembolic state and potential thermal injury." Some of these products may also be difficult to remove in the emergency department.

Your workplace Medical Director can approve or require the use of certain blood-clotting products. Follow your Medical Director's protocol and the manufacturer's guidelines for use of hemostatic agents in the workplace.

## Internal Bleeding

Damage or injury to the chest, abdomen, or pelvis can lead to bleeding that is concealed within the body. Swollen, deformed and painful extremities can also indicate internal bleeding. A victim can lose blood rapidly from an injury to the liver or spleen, or from fracture of the pelvis or a long bone such as the femur (thigh). The main concern with internal bleeding is shock.[43]

Common causes of internal bleeding include both blunt and penetrating trauma incidents such as automobile accidents, broken bones, knife and gunshot wounds. Medical problems relating to the lungs, stomach or intestines can also result in internal bleeding.

**Initial Signs & Symptoms:**

- Discolored, tender, swollen or hardened skin or tissues, especially in the abdominal area and suspected fracture sites
- Rapid respiratory and pulse rates
- Pale, cool, moist skin
- Abdominal pain, tenderness, rigidity; guarding of the abdomen
- External bleeding from a natural opening (e.g. mouth, nose, ear, rectum, vagina, urethra)
- Nausea; vomiting or coughing up blood (bright red or coffee ground appearance)
- Dark tarry or bright red stool
- Mental status changes: confusion, irritability
- Dizziness, unresponsiveness

**Treatment:**

1. Scene safety, PPE, get first aid kit and AED.
2. Assess response, breathing, circulation and appearance.
3. Call 9-1-1. Do not wait for the victim to visit the doctor on his or her own.
4. Calm and reassure the victim.
5. Treat for shock.
    a. Place in a position of comfort.
    b. Keep warm.

6. Monitor status.

## Nosebleeds[44,45,46]

Nosebleeds occur when the small blood vessels inside your nose break and bleed, usually due to dryness or minor irritations. Most bleeding is from the nasal septum which separates the two sides of the nose. Nosebleeds are very common and rarely life threatening.

Occasionally a nosebleed may be a sign of a more serious problem, such as hypertension. As blood pressure increases, the small arteries in the nose begin to bleed. This may be a warning sign of an impending stroke.

**Treatment:**

1. Sit down and tilt your head slightly forward.
2. Pinch the soft part of your nose (just below the bony part) for 10 minutes. Breathe through your mouth.
3. Apply an ice pack wrapped in a moist cloth to the bridge of the nose, if it does not interfere with direct pressure.

**Do not**:

- Do not lie down or tilt your head back. This position will cause blood to flow down the back of the throat, possibly upsetting your stomach and causing vomiting.
- Do not pack your nose with gauze to stop the bleeding.
- Do not put your head between your knees; this will increase the blood pressure to the veins of the nose, resulting in more bleeding.
- Do not blow your nose soon after bleeding has stopped.

**Get medical help if:**

- Your nose bleeds for more than 15-20 minutes.
- You have difficulty breathing.
- The bleeding is very fast or heavy.
- You feel dizzy or weak.
- It occurs after an injury to the head. It may indicate a skull fracture or broken nose.
- The nosebleed is associated with hypertension.

**Senior**: Blood thinners or aspirin may cause or even worsen nosebleeds.
**Child**: Nosebleeds in children are commonly due to an object stuck in the nose or to nose picking. Caregivers should try to peer inside the child's nostrils and trim fingernails as needed.

A person who experiences frequent nosebleeds should see a doctor for evaluation. Repeated nosebleeds may indicate hypertension, allergies, a tumor of the nose, or a bleeding disorder.

Help prevent nosebleeds by using a humidifier, nasal saline spray or water soluble jelly.

## Blisters[47]

A blister is an area of raised skin filled with a watery liquid. It is usually the result of friction, such as when you develop a blister on your heel from wearing a new pair of shoes, or a blister on your hand from using a shovel. A blister may also occur as the result of a 2nd degree burn or a skin rash.

Prevent a blister before it develops. Wear the right shoes for the right task, and ensure that they fit well. Use gloves when indicated for physical labor. Wear sunscreen to avoid sunburn.

If you do develop a blister, **do not pop it**. The layer of skin over the blister is keeping microorganisms and foreign particles out of the wound, and maintaining a clean and moist healing environment. Keep the blister clean and dry, cover it with a bandage, and try to avoid putting pressure on it.

If the blister does pop, follow the Minor Wound Treatment protocol. Consult with a physician if you develop signs of infection or for treatment of a large blistered area.

## Splinters[48]

A splinter is defined as a thin piece of material (e.g. wood, metal, glass) that gets embedded just below the top layer of skin (epidermis). Depending on the location of the splinter, it can be very irritating and painful. Most splinters can be removed without medical assistance.

### Splinter Removal

1. Wash your hands and clean the area thoroughly with soap and water.
2. If the splinter sticks out from the skin:
    a. Use clean tweezers to grab the splinter and carefully pull it out at the same angle that it went in.
    b. If the splinter is small and you can't grab the splinter with tweezers, apply a piece of sticky tape over the splinter and pull off the tape to remove the splinter.
3. If the splinter is hard to grab or is under the skin:
    a. Sterilize a sharp needle with rubbing alcohol or by placing the tip in a flame.
    b. Use the needle to carefully remove skin over the splinter and lift the tip of the splinter out.
4. Follow Minor Wound Treatment guidelines.
5. Apply a bandage if the wound may get dirty.

You may also purchase a splinter removal kit to place in your first aid kit. Seek medical attention if the splinter is close to your eye, if there are signs of infection, or if it is large or deeply embedded.

# Burns

## Overview[49,57,58,59]

There are about 450,000 burn injuries requiring medical attention each year in the U.S. About 45,000 burn victims are admitted to hospitals: half go to specialized burn treatment centers, and half to regular acute hospitals. There are an estimated 3,500 fire and burn deaths per year. The death rate from fire and burns has declined steadily over the years. Children age 4 and younger and adults age 65 and older are most at risk of fire-related injuries and death.

Smoke alarms decrease your risk of dying in a fire by 50%. Only 60% of the people in the U.S. have a fire escape plan, and only 25% have practiced it.

While some burns are minor, others can cause permanent injury or even death. Fast, effective burn treatment can minimize the degree of injury, and even save a life.

Burn treatment is directed toward stopping further burning, and making the victim as comfortable as possible while awaiting emergency medical care. The young and the elderly have the most difficulty recovering from severe burns. Critical burn areas include:

- Head
- Neck
- Hands
- Feet
- Genitals
- Over a large joint

Burns on these areas are more serious due to the potential for complications. Scarring can significantly impair appearance, movement and function, resulting in the need for cosmetic surgery or skin grafts.

## Types of Burns[50,51,52]

**Thermal burns** are caused by direct or radiant heat exposures to extreme temperatures. They result from fire, steam, hot liquids, or other exposure to increased temperature. The first action is to stop the heat source. Deaths from fire often result from smoke inhalation rather than heat or flames. Victims may suddenly develop signs of respiratory distress. Rescuers should be cautioned to observe for evidence of respiratory tract burns such as soot or singing of hairs around the mouth and nose.

**Chemical burns** require large amounts of water to flush chemicals from the skin. Powdered chemicals should be brushed from the skin, followed by flushing for 20 minutes. Do not use bare hands to brush off the chemicals. Ensure run-off water

does not flow over unaffected skin or onto the rescuer. Follow the first aid directions on the label of the chemical container; locate the Material Safety Data Sheet (MSDS). Contact the Poison Control Center. Obtain medical care as soon as possible.[53,54]

When treating a victim with an **electrical burn**, the most important consideration is to make sure the power supply has been turned off. Rescuers should not attempt to remove anyone from an electrical source unless they are specially trained to do so. After the power source has been eliminated, treat the burn. Electricity follows the path of least resistance through the body. Commonly there is an entrance and exit wound.

Electrical burns can cause deep tissue injury and are always more severe than the external signs indicate. Cardiac or respiratory arrest can also be caused by electrical shock. Ordinary household current is powerful enough to cause severe burns. All victims of electrical burns need to be evaluated by a physician. **7**

## Assessment of Burns[50,51,52]

### Degree of Burn

**1st Degree Burn:** Burns the outer layer of skin (epidermis). There is redness, pain, and swelling.

**2nd Degree Burn:** (or partial thickness burn) Burns the second layer of skin (dermis). There are blisters, severe pain, and swelling, with a red and splotchy appearance.

**3rd Degree Burn:** (or full thickness burn) Burns all layers of the skin. It may involve fat, muscle and even bone. There is no pain because nerve endings have been damaged. Burned areas may appear charred black or gray and white. If there was smoke inhalation, there may also be respiratory system damage. The victim may complain of pain if areas of 1st or 2nd degree burns surround the 3rd degree burns. Activate EMS, because 3rd degree burns are life threatening.

### Rule of 9s

The Rule of 9s may be used to quickly assess the total body surface area (BSA) burned. It divides the body up into units of surface area divisible by nine in the following way:

**Adult:** (age 10 and older)

Head = 9%
Torso (chest and abdomen) = 18%
Entire back = 18%
Entire arm (front and back) = 9%
Entire leg = 18%

**Infant:** (up to age one; has a relatively larger head)

Head = 18%
Torso = 18%
Entire back = 18%
Entire arm = 9%
Entire leg (front and back) = 14%

**Child:** (age 1 to 9)

- The Rule of 9s is not as accurate for children due to the relative disproportion of body part surface area.
  - The head, neck and shoulders are larger.
  - The hips and legs are smaller.
- Decrease head size and increase lower extremity size 1% annually (0.5% each leg).

**Rule of Palm:** For scattered or small burn surfaces, the victim's palm = 1% BSA.

**Burn Care**[50,51,52,56]

***Cool Burns with Water***

The preferred treatment for small or minor thermal burns is cooling the area with water. In addition to providing pain relief, cool water will help stop the spread of the burn. Continue the cooling process until the pain is relieved. If the victim begins to shiver, discontinue the cooling process. Hypothermia may occur because extensive burns reduce the body's ability to retain heat.

***Cover the Victim***

Prevent further heat loss by covering the victim. Quickly estimate the burn area, and then cover with a clean white sheet, blanket or other clean large cover. Remove any clothing or jewelry that does not stick to the burned skin. Jewelry retains heat and will continue to burn even after the heat source has been removed.

**Burn Treatment:**

1. Ensure scene safety. If electrical burn is suspected, ensure power source is eliminated.
2. Extinguish flames (stop, drop and roll); remove victim from environment if there is smoke and heat.
3. Activate EMS (call 9-1-1) for a critical burn.
4. Assess response, breathing, circulation and appearance. Assess airway for evidence of respiratory tract burns such as singed hairs or soot around the mouth or nose. Airway burns cause swelling, which may close the airway.
5. Cool small or minor thermal burns with water to relieve pain and stop the burning process.
6. Cover the burn area with a dry, sterile dressing, or a clean sheet for a large burn area. Keep as clean as possible to reduce risk of infection.
7. Assess for other life-threatening traumatic injuries.
8. Treat for shock.

9. Remove clothing or jewelry that does not stick, because burned areas swell quickly.
10. Stop the cooling process if the patient begins to shiver.
11. Maintain an open airway and continue to monitor breathing.

- **Do not** break blisters. They protect the burn area from infection.
- **Do not** apply ice directly onto the skin.
- **Do not** apply butter, ointment or creams to a severe burn.

**Activate EMS for a critical burn:**

- Burn to head, neck, hands, feet, genitals, or over a major joint
- Large burn area or multiple burn sites
- Burn to the airway or difficulty breathing
- 3rd degree burn, especially to the elderly or very young
- Chemical or electrical burn
- Burn with other traumatic injuries

**Do not** use butter, oil, salve or petroleum-based creams for the initial treatment of burns. These retain heat and allow the burning process to continue. They are also painful to remove for wound assessment. After medical evaluation of the burns, appropriate wound and burn care products may be used.

***Fire Safety Tips:***[56]

1. If your clothes catch on fire, don't panic: stop, drop and roll.
2. Escape first, and then call for help. If you cannot escape immediately, use the phone and call the fire department, yell for help, or wave a sheet or large object out the window to attract attention. Close all the doors that you can between yourself and the fire. Use rags to seal the door.
3. Know two ways to escape from every room. Windows can be considered emergency exits.
4. Practice escape routes, and keep them free of clutter.
5. Establish a meeting place at a safe distance outside the building.
6. Do not open doors that are hot to the touch. Open cool doors slowly, and slam them closed if smoke pours in.
7. When escaping, never stand up; crawl low, and keep your mouth covered with a moist cloth. Smoke rises, so the air is cleanest low to the ground.
8. Place smoke alarms in each room; change the batteries annually.
9. Respond to every alarm as if it were a real emergency.
10. Equip security bars or windows with a quick-release.
11. Never use an elevator during a fire.
12. Never re-enter a burning building to search for missing people or pets, or to retrieve property. Always wait for firefighters.

# Chest and Abdominal Emergencies

## Rib Fractures or Flail Chest[60]

A **rib fracture** is painful but rarely life-threatening. The treatment for a single rib fracture is usually pain medication and encouragement to continue taking full, deep breaths in order to prevent a lung infection.

Complications may occur when sharp bone ends cause serious injuries, such as a punctured lung or lacerated liver. Observe for signs of internal bleeding or respiratory distress; limit activity and treat accordingly.

A **flail chest** occurs when two or more ribs are broken in at least two places, or when the ribs are separated from the sternum (breastbone), producing a free-floating (flail) segment. Due to the instability of the chest wall, these broken ribs no longer aid in the breathing process. The flail area can damage the lung beneath it by bruising or puncturing it, causing severe bleeding and possibly shock.

**Signs and Symptoms:**

- Consider the mechanism of injury (how the injury occurred).
- Bruising
- Pain with a deep breath
- Tenderness when palpating the injured area
- Swelling
- Deformity
- Paradoxical movement (The flail segment moves in the opposite direction of the rest of the chest. As the patient breathes in, the flail section appears to sink into the core of the body. As the person exhales, the flail section appears to be pushed from the core.)

**Treatment:**

1. Assess response, breathing, circulation and appearance.
2. Activate EMS (call 9-1-1).
3. Consider cervical spine (neck) damage based on how the injury occurred.
4. Treat for shock.

## Sucking Chest Wound[61,62]

Trauma that has punctured the chest wall may create a sucking chest wound (**open pneumothorax**). Each time the person breathes, a sucking sound is caused by the passage of air through the wound. Air rushes into the chest cavity, collapsing the lungs and preventing normal breathing. This severely reduces the lungs' ability to provide fresh oxygen to the blood, and is a life-threatening situation.

**Signs and Symptoms:**

- Difficulty breathing
- Sharp chest pain
- Bluish skin color

- Anxiety
- Sucking sound with breathing
- Trauma to chest/ribs

**Treatment:**

1. Assess response, breathing, circulation and appearance.
2. Activate the EMS system (call 9-1-1).
3. Keep the person still.
4. Apply an airtight dressing (e.g. aluminum foil, plastic wrap, folded universal dressing) to keep air from entering during inhalation. Tape only three sides so that air can escape during exhalation to prevent pressure buildup.

## Abdominal Wounds

An **open abdominal wound** is usually caused by a penetrating injury and may expose internal organs. In extreme cases, organs may protrude through the wound (evisceration). Do not remove objects impaled in the abdomen. Do not attempt to push abdominal organs back in.

A **closed abdominal wound** (skin remains intact) is usually caused by blunt trauma injury (e.g. steering wheel, seat belt, baseball bat, fall). Consider how the injury occurred and the need for spine immobilization. Watch for signs of internal bleeding. Common causes of internal bleeding include automobile accidents, knife and gunshot wounds, as well as medical problems related to the stomach and intestines.

**Signs and Symptoms:**

- Weak, rapid pulse
- Pale, cool, moist skin
- Abdominal pain, tenderness or rigidity
- Nausea or vomiting
- Vomit that is bright red or looks like coffee grounds
- Dark tarry or bright red stools
- Back pain (kidney damage)

**Treatment:**

1. Assess response, breathing, circulation and appearance.
2. Activate EMS (call 9-1-1).
3. Position on back with knees bent if does not increase pain.
4. Treat for shock.
5. Stabilize foreign object in place with a bulky dressing and adhesive tape. **Do not** remove.
6. Cover eviscerated organs loosely with a moist, sterile dressing.
7. Cover dressing loosely with plastic wrap.
8. Do not give food or drink.

## Appendicitis[63]

The appendix is a small, finger-like pouch attached to the intestines in the lower right side of the abdomen. When it is blocked, it becomes inflamed and infected, a

condition known as appendicitis. It is most common in people between the ages of 10 – 30.

If appendicitis is not detected early enough, the appendix may rupture, leading to peritonitis (infection of the lining of the abdomen). The contents of your intestines and the infected appendix will spread throughout the peritoneal cavity. This is an extremely serious complication, and may even result in death. Children are more likely than adults to have a ruptured appendix because their symptoms may vary, or the parents may think the child just has a stomachache.

**Signs and Symptoms:**

- Abdominal pain in the lower right abdomen. The exact location of the pain may vary.
- Increased pain with palpation of the lower right abdomen
- Nausea and vomiting
- Loss of appetite
- Low-grade fever
- Distended (swollen) abdomen
- Constipation

The treatment for appendicitis is surgical removal of the appendix. If you suspect appendicitis, visit your doctor promptly. If you have symptoms of peritonitis, it is a medical emergency. Activate EMS or go directly to the nearest hospital emergency room for evaluation.

## Pregnancy-Related Emergencies[14]

Treatment of **pregnancy-related emergencies** is extremely complex. First aid responders should activate EMS at any sign of sudden illness, complications, or injury. All pregnancy-related abdominal injuries should be evaluated by a physician. Position a pregnant woman on her **left** side to improve maternal blood flow and breathing.

A full term pregnancy lasts approximately 280 days from the first day of the last normal menstrual period, and is divided into 3 "trimesters." The baby, or "fetus," develops in the mother's uterus. After this 9-month developmental process, the baby emerges through a process termed "labor."

### *1st Trimester*

**Miscarriage**: Loss of the pregnancy before the 20th week. One out of five pregnancies results in a miscarriage. Causes of a miscarriage can include:

- Acute/chronic illness in the mother
- Abnormalities of the fetus
- Abnormal attachment of the placenta

**Signs and Symptoms:**

- Vaginal bleeding, often heavy
- Cramping abdominal pain
- Passage of tissue

**Ectopic pregnancy**: Occurs when the egg becomes implanted outside of the uterus. As the egg begins to grow, it can rupture surrounding tissues and blood vessels.

**Signs and Symptoms:**

- Lower abdominal pain (Abdominal pain in a female patient of childbearing age should be considered an ectopic pregnancy until proven otherwise.)
- Signs of shock
- Missed menstrual period

***2nd Trimester***

Complications during the 2nd trimester are relatively rare, although miscarriages may occur during this time.

***3rd Trimester***

**Abruptio Placenta:** Occurs when the **placenta** (the organ which nourishes the fetus) prematurely separates from the wall of the uterus. A large placental separation can result in massive maternal bleeding and fetal death. This condition is more likely if the mother has a history of hypertension, many pregnancies, or a previous history of abruptio placenta. This occurs in one out of 400 pregnancies.

**Signs and Symptoms:**

- Sudden severe, constant abdominal pain
- Bleeding, dark red (not always present)
- Signs of shock
- Frequently occurs after trauma (e.g. a fall or motor vehicle accident)

**Placenta Previa** occurs when the placenta (normally situated near the top of the uterus) forms over the opening to the birth canal. It can result in severe bleeding as the uterus opens during the start of labor and tears the placenta. This occurs most often in women over the age of 35, or women who have had many previous pregnancies.

**Signs and Symptoms:**

- Painless vaginal bleeding, bright red
- Signs of shock

**Pregnancy Induced Hypertension** (PIH), formerly called eclampsia, develops gradually during the pregnancy. It is characterized by sudden weight gain, blurred vision, swelling of the face/hands/feet, and an increasing blood pressure. The most serious complication of PIH occurs during the 3rd trimester, when the patient may

develop seizures. Seizures are very harmful to the fetus because they deprive it of oxygen.

**Treatment for all pregnancy-related emergencies:**

1. Assess response, breathing, circulation and appearance.
2. Treat for shock; place mother on her left side.
3. Maintain temperature.
4. Save any passed tissue.
5. Rapid transport to the hospital emergency room (activate EMS).

## Childbirth

Childbirth is seldom an emergency situation, but all first aid providers should be prepared to assist with the delivery and initial care of the newborn.

**Labor is characterized by 3 phases:**

***First Phase: The onset of labor to the opening of the birth canal.***

Labor contractions are generally a cramping pain that radiates from the front to the back, at approximately 5 – 15 minute intervals. They become increasingly longer, more intense, and closer together as delivery of the baby nears. Labor can last many hours. Typically, labor becomes shorter and less severe with each subsequent pregnancy.

***Second Phase: The opening of the birth canal to the delivery of the baby.***

This phase is the actual delivery of the newborn. You can determine that birth is imminent if:

- Contractions are less than five minutes apart.
- The mother feels an urge to push or bear down. Do not let her go to the bathroom!

If delivery is imminent you should assist the mother by supporting the infant as he/she emerges. DO NOT PULL! Protect the infant from falling; he/she will be very slippery. You can anticipate about two cups of blood-tinged fluid to be expelled with the baby.

Your first priority after delivery of the newborn is to assess response, breathing, circulation and appearance. Provide ventilation as needed. The baby's temperature must be maintained: quickly but gently dry off the baby and wrap him or her in blankets; ensure that the head is insulated and the face is visible.

***Third Phase: Delivery of the baby to the delivery of the placenta.***

This phase is the delivering of the placenta. The mother will begin to feel contractions again, and in 15-30 minutes will deliver the placenta. Transportation to the hospital should never be delayed waiting for the delivery of the afterbirth.

**Complications**

**Abnormal presentations**: Usually the baby presents headfirst. On a rare occasion, an arm, leg or buttocks (breech) appear first, or the umbilical cord protrudes from the birth canal. These are all true emergencies and usually require a C-section to deliver the baby. The best treatment is safe, rapid transport to the emergency room. Activate EMS (call 9-1-1).

# Choking Management- Adult, Child and Infant

## Introduction

Choking is a common cause of unintentional injury in a child or infant, even though it is preventable. Severe airway obstruction, if not treated in the first few minutes, will result in death. Treatment is usually successful, with survival rates above 95%. Most deaths from choking occur in children younger than 5; 65% of them are infants.

When teaching FBAO management, instructors should focus on preventing the causes of choking, recognizing a choking emergency, understanding and recognizing the difference between mild and severe obstructions, and treatment of the responsive and unresponsive choking victim.

Although studies have shown that chest thrusts, abdominal thrusts, and back blows (slaps) are all effective in relieving an obstruction, students are trained to give only abdominal thrusts to a responsive victim age 1 or older for simplicity of training. Infants are given a combination of chest thrusts and back slaps. Chest thrusts are given to a large or pregnant victim, and CPR is given to an unresponsive victim of choking. [3]

### Causes of Choking in the Unresponsive Victim

When a person is unresponsive, the tongue is the most common cause of obstruction. The tongue may fall backwards into the upper airway and block the entrance of air. Other causes of choking in the unresponsive victim can also include blood from head and facial injuries, and regurgitated (vomited) stomach contents.

### Causes and Prevention of Adult Airway Obstruction[3,4,64]

Any time a responsive person **suddenly** stops breathing, becomes cyanotic (blue) and eventually becomes unresponsive, choking should be considered a potential cause of the person's condition, especially in a younger victim. Signs such as coughing or stridor (high-pitched sound), without accompanying fever or other respiratory symptoms, may also indicate a serious obstruction.

Common factors that contribute to choking in a responsive adult include poorly chewed food, elevated blood alcohol level, dentures, and talking and laughing while eating. Meat is the most common food associated with adult choking.

***Tips to Prevent Adult Choking:***

1. Cut food into small pieces; chew completely and eat slowly.
2. Denture wearers should exercise extra caution when eating.
3. Avoid talking and laughing when chewing and swallowing food.
4. Avoid excessive alcohol intake.

### Causes and Prevention of Child and Infant Airway Obstruction

Most reported episodes of choking in infants and children occur when parents or caregivers are close by, usually during eating or play. Food or small objects are the most common obstructions in children, while liquid obstructions, such as juice or formula, are the most common obstructions in infants and younger children.[3,4]

#### *Tips to Prevent Child and Infant Choking*

1. Cut food into small pieces; chew completely and eat slowly.
2. Encourage children to sit at the table until finished eating; do not allow them to run or otherwise play with food or objects in their mouth.
3. Avoid talking and laughing when chewing and swallowing food.
4. Do not have objects around small children and infants that will fit through a standard roll of toilet paper.

### Recognition of Choking[3,4,64]

Knowing what to do won't help if rescuers don't recognize the emergency. Rescuers need to be able to differentiate between a choking emergency and other emergencies such as fainting, heart attack, seizure, asthma, stroke, or other causes of acute respiratory distress or unresponsiveness.[3]

The **sudden onset** of respiratory distress associated with coughing, gagging, or a high-pitched noisy or wheezing sound when breathing (stridor) should cause rescuers to consider a choking emergency. Be alert to potential choking while a person is eating or a small child is playing.

Airway obstructions can be classified into two groups: **mild obstruction** and **severe obstruction**. During a mild airway obstruction the victim will be able to breathe with good air exchange, as evidenced by a forceful cough or the ability to speak or cry audibly. If the victim of a mild airway obstruction has good air exchange and can cough forcefully, do not interfere, as coughing is the best way to relieve an obstruction.

## Severe Airway Obstruction

A victim with a severe airway obstruction is unable to breathe, speak, make sounds, or cough effectively. These signals usually develop suddenly with no other signs of illness or infection.

### Signs of a severe choking emergency include:

- Inability to speak, cry or make sounds
- Weak, ineffective cough
- Cyanosis (blue color, especially around the lips and fingernail beds)
- High-pitched sounds with inhalation (stridor) or wheezing
- Difficulty or no breathing
- Bulging, tearing eyes
- Universal sign of choking (an adult or child may grasp the throat with one or both hands)

## Relief of Choking in a Responsive Child or Adult[3]

Immediate action is required for a severe obstruction. The foreign object blocking the airway needs to be removed quickly, or the victim will soon become unresponsive and die.

Abdominal thrusts, also known as the Heimlich maneuver, are the preferred technique to relieve an obstruction in the responsive adult and child (age one or older). Abdominal thrusts performed in the subdiaphragmatic area (below the diaphragm) elevate the diaphragm, increasing airway pressure and forcing air from the lungs. This creates an artificial cough and expels the foreign body from the airway.

1. Identify if the victim is choking by asking, “Are you choking?”
2. If the victim nods “yes” or is unable to speak, he or she has a severe obstruction. Do not leave the victim if you are alone with him or her.
3. With the victim sitting up or standing, stand behind the victim and wrap your arms around his or her midsection, keeping your arms under the victim’s arms. For a child or shorter victim, you may need to kneel down.
4. Make a fist with one hand and place it just above the navel, well below the xiphoid process (tip of the sternum), with the thumb side against the abdomen.
5. Grasp the fist with your other hand and perform a quick inward and upward thrust.
6. Repeat the abdominal thrusts one after another until the obstruction is relieved or the victim becomes unresponsive. Deliver each thrust with the intent to relieve the obstruction.

## Relief of Choking in a Responsive Infant[4]

When the choking victim is an infant age one or younger, use a combination of back blows (slaps) and chest thrusts. If the victim is older than one year, use abdominal thrusts, as with an adult victim.

**Perform Back Slaps and Chest Thrusts:**

1. Identify if the victim is choking; observe for inability to cry or cough effectively, cyanosis, bulging or tearing eyes. If the victim is unable to make sounds or has other signs of severe airway obstruction, send a bystander to call 911. Do not leave the infant if you are alone with him or her.
2. Hold the infant face down with the head slightly lower than the chest, resting on your forearm. Support the head by grasping the jaw, not the throat. Rest your forearm on your thigh to support the infant.
3. Deliver 5 back slaps forcefully in the middle of the back between the infant’s shoulder blades.
4. Place your free hands on the infant’s back and turn the infant while carefully supporting the head and neck.
5. Hold the infant face up, with the head lower than the body.
6. Provide 5 quick downward chest thrusts using the same landmark and hand position as those of infant CPR (lower half of the sternum), approximately 1

per second. Give each thrust with the intention of creating an "artificial cough" to dislodge the foreign body.
7. Repeat the sequence of 5 back slaps and 5 chest thrusts until the object is expelled, the infant cries or becomes unresponsive.

***Complications Associated with Abdominal Thrusts***

Abdominal thrusts may lead to complications, such as damage to the internal organs. Victims who receive abdominal thrusts should be evaluated by a physician to rule out any serious complications. Minimize the risk of complications by ensuring your hands are located below the xiphoid process and above the navel in the midline of the stomach area during abdominal thrusts.

When dealing with an infant, there is a lack of protection of the upper abdominal organs by the rib cage, creating additional risk of injury during the performance of abdominal thrusts. Because of the increased risk of injury, abdominal thrusts are not recommended for the relief of choking in an infant victim.

### Chest Thrusts on a Pregnant or Large Victim[3]

When a person is pregnant or large, the method of using abdominal thrusts to remove an FBAO is not recommended. Rescuers may not be able to reach around the midsection of a pregnant or large victim. Rescuers should use chest thrusts instead of abdominal thrusts if the victim is pregnant to provide a more effective method of removing the FBAO, and to avoid injury to the fetus. Use the following steps:

1. Stand behind the victim and wrap your arms around the chest, under the armpits.
2. Place one fist in the middle of the victim's sternum, above the xiphoid process with your thumb against the chest. This is the same location as chest compressions in CPR.
3. Grasp the fist with your other hand. Perform continuous backward thrusts until the object is expelled or the victim becomes unresponsive.

## Unresponsive Adult Choking Victim[3]

When a rescuer is performing abdominal thrusts on a responsive adult who becomes unresponsive, use the following guidelines.

1. Pull the victim close to your body and assist to the ground.
2. Send a bystander to call 911; if alone with an adult victim, immediately activate EMS, then return and begin CPR.
3. Perform CPR with the added step of looking in the mouth after each set of compressions. If you see the obstruction, remove it and continue CPR.
    a. If you see the obstruction, sweep it up and out of the mouth with your gloved finger.
    b. Do not blind sweep the airway.
4. Perform CPR until the victim begins to breathe normally.

## Unresponsive Child or Infant Choking Victim[3,4]

When a rescuer is performing abdominal thrusts on a responsive child choking victim who becomes unresponsive, use the following guidelines.

1. Place the victim on the ground or on a firm, flat surface such as a desk.
2. Send a bystander to call 911. If alone with a child or infant victim, perform CPR for two minutes before going to call 911.
3. Perform CPR with the added step of looking in the mouth after each set of compressions. If you see the obstruction, remove it and continue CPR.
    a. If you see the obstruction, sweep it up and out of the mouth with your finger.
    b. Do not blind sweep the airway, especially in a child or infant.
4. Call 9-1-1 after about 2 minutes of CPR.
    a. You may bring an uninjured infant with you to the phone.
5. Perform CPR until the victim begins to breathe normally.

## Alone and Choking

A choking victim can attempt abdominal thrusts on him or herself to relieve an FBAO. *Caution: These methods can cause internal injury.*

### Self-Administered Abdominal Thrusts

Make a fist with one hand and place it with the thumb side against the abdomen, above the navel and below the xiphoid process. Grasp the fist with your other hand and perform quick upward thrusts.

Another option when alone and choking is to use a firm surface to perform the abdominal thrusts. The victim should press the upper abdomen over the back of a chair, side of a table, railing, or any firm surface. Several thrusts may be needed to relieve the obstruction.

You can also call 911 from a land line and leave the phone off the hook. Go outside to attract attention and wait for help.

# Cold Emergencies

## Hypothermia[66]

Hypothermia occurs when the core body temperature drops to 95° F or below. It may result when the body loses more heat than it produces. The body's internal control mechanism fails to maintain the normal body temperature of 98.6° F. Nearly 700 people die of hypothermia annually in the U.S.

There are five ways that the body loses heat:

- **Conduction**: Losing heat from touching an object that is colder than the body.
- **Convection**: Heat transfer from the circulation of currents from one region to another. (e.g. A person wearing lightweight clothing outside loses heat to the air when cool air moves across the body.
- **Evaporation**: Body heat is lost when sweat or water evaporates from the skin.
- **Radiation**: Heat loss from being in a cold environment (e.g. a cold room, or outdoors)
- **Respiration**: The exhalation of warm air from the lungs releases body heat.

Immersion in cold water is the most common cause of hypothermia. Your body loses heat in water up to 25 times faster than it does in air. The colder the water, or the longer you are in the water, the less the chance of survival. Hypothermia does not occur solely in extremely low temperatures. Cases have been recorded in temperatures as high as 65° F. Hypothermia can be mild, moderate or severe. Death due to cardiac and respiratory failure may result within hours of the first signs and symptoms.

The greatest risk is to the elderly and very young, whose body temperature regulation mechanisms do not work as well or are not fully developed. Children in general are more prone to heat loss because they tend to lose more heat through their head, which is disproportionately larger than an adult's head. They also may not take adequate precautions against the cold. Homeless people and those who are exposed to the elements are also at risk. People with medical conditions that impair sensation, blood flow or movement, and those who are mentally ill or impaired, have an increased risk for hypothermia. Alcoholics are also at higher risk.

**Signs and Symptoms:**

- Shivering is the body's attempt to generate heat. (It will stop after the body core temperature drops below 90° F.)
- Cold, gray skin
- Drowsiness
- Slurred speech
- Exhaustion
- Unresponsiveness
- Abnormally slow breathing rate

**Treatment:**

1. Assess response, breathing, circulation and appearance.
2. Activate EMS (call 9-1-1).
3. Remove from cold environment.
4. Remove damp clothing; replace with warm and dry clothing, blankets, etc.
5. Insulate head – victim can lose up to 70% of body heat through the scalp.
6. Place victim in warm environment (inhalation re-warming).
7. Use your own body heat to warm the person.
8. If far from medical care, warm with heat pads or containers of warm water. Keep a barrier between heat source and skin.

**Do not** manipulate extremities. Doing so forces cold blood back to the heart, which may result in cardiac arrest.
**Do not** give alcohol or coffee (caffeine).
**Do not** apply direct heat if near medical care.

When the person is transported to the hospital, the doctor may warm the person from the inside out. The person may receive warm fluids directly into a vein (I.V.), or in a severe case of hypothermia, may receive hemodialysis to remove the blood, warm it rapidly outside the body, and then return it to the body.

## Frostbite[67]

Frostbite is caused by prolonged exposure to cold as body tissues actually become frozen. As the tissue begins to freeze, ice crystals develop, damaging the cells in the frozen area. It most commonly affects the hands, feet, cheeks, ears and nose.

Frostbitten skin appears white and waxy, and feels numb and hard. Frostnip (white, numb skin) is an early indication of frostbite. Prevent frostbite by recognizing the early signs of frostnip.

Children are more at risk of developing frostbite than adults, as they lose heat more rapidly than adults, and they may be more reluctant to go indoors from their outdoor play.

**Signs and Symptoms:**

- Pale, cold, waxy skin
- Painful, burning sensation, or numbness
- Blisters

**Treatment:**

1. Assess response, breathing, circulation and appearance.
2. Activate EMS (call 9-1-1).
3. Remove victim from environment.
4. Remove wet clothing; replace with dry clothing, blankets, etc.
5. Place frostbitten part next to your body.
6. Remove rings, bracelets and watches.

7. Avoid partial thawing and refreezing. It may cause severe tissue damage.

**Do not** pop blisters.
**Do not** re-warm with direct heat (over a stove, open flame or with heating pad).
**Do not** rub frostbitten skin.

It is critical that a victim of frostbite receive emergency medical help right away. If help is delayed, you can warm severely frostbitten hands or feet in warm (not hot) water (about 100-104° F). Do not let the frostbite victim determine the water temperature, because he or she cannot feel the heat and may be severely burned. It is important that the frozen areas **slowly** warm, over 25-40 minutes, to avoid causing tissue damage.

As the frozen tissue gradually thaws, it will become red and painful. Keep warming frostbitten parts until normal sensation, movement and color have returned. Cover the frostbitten areas with dry sterile dressings, and do not disturb any blisters.

***Tips to Prevent Hypothermia and Frostbite:***[68]

- Wear extra clothing in loose layers to keep you warm in cold weather.
- Wear clothes that are windproof and water-resistant.
- Cover your head, hands and feet when outdoors in cold weather.
- Keep as dry as possible.
- Be aware of changing weather conditions and wind chill factor.
- Pay attention to early signs of hypothermia.
- Take frequent breaks indoors to warm up.
- Keep your vehicle in good repair to avoid risking a break down in cold weather.
- Heat your home in cold weather, especially at night.
- Drink warm, sweet drinks for energy. It takes energy to keep your muscles warm.
- Do not drink alcohol to keep warm. Although alcohol gives a temporary “warming” sensation, it causes vasodilation, which lowers your body’s ability to retain heat.
- Avoid overexertion in cold weather. Sweating in cold weather can cool the body too much. If you do exercise, wear a base layer of clothing that will wick (draw) sweat away from your body and keep your skin dry.
- If trapped in your car in the snow, avoid running your car for extended periods, as fumes may enter the car. Snow may also block the exhaust system.

# CPR

## C-A-B (Compression-Airway-Breathing)[3,70,71]

### Introduction

Recognition of cardiac arrest, activation of EMS and immediate CPR is critical to survival of Sudden Cardiac Arrest (SCA).

C-A-B stands for Compression, Airway and Breathing. The acronym identifies the sequence of actions that give an SCA victim the best chance at survival. The C-A-B sequence is used by community and professional responders for resuscitation of adults, children and infants.

### Check for Response

If a responder witnesses the sudden collapse of a person or finds a person down, ensure the scene is safe and put on PPE, then check the victim for response.

Go to the side of the victim; tap the victim on the shoulder and shout, "Are you alright?" Assess for any response that could be a sign of life, such as eyes opening, moaning, breathing or talking. Checking for a response should only take a few seconds. **Do not** delay calling 9-1-1 to check for breathing. If there is no response, activate EMS.

#### *Activate EMS*

Any time a bystander is available, send him or her to call 9-1-1 and get an AED if one is available. Identify a person and state, "You. Go call 9-1-1, get the AED and come right back." If there is more than one bystander, split the tasks. Other bystanders can be sent to meet the EMS responders outside and guide them to the scene.

When alone with an unresponsive adult victim, go call 9-1-1 yourself, and then check for breathing.

#### *Check for Breathing*

Scan the victim for breathing for 5-10 seconds. If there is no breathing or only gasping, immediately begin the C-A-B sequence starting with chest compressions.

### C: Compression

When sudden cardiac arrest occurs, the victim usually has unused oxygen in the blood and lungs.[72] The problem is that the heart isn't pumping it. By starting with compressions, responders circulate the oxygenated blood already present in the body.

Quality chest compressions are directly linked to survival of SCA.[73] Sadly, most responders do not start compressions soon enough, or push fast or hard enough.[74]

Beginning quality compressions early and minimizing interruptions increases the odds for survival. Delayed, interrupted or poor compressions have the opposite effect.
Compressions are tiring and even the fittest responders fatigue quickly. If a second responder is available, quickly switch responders every two minutes to maintain good quality compressions. To begin the C-A-B sequence, the responder and the victim must be positioned correctly.

***Victim Positioning for Chest Compressions***
Position the victim face up on a firm, flat surface. If the victim's head is raised above the heart, there is little to no blood flow to the brain. Soft surfaces, such as a bed or couch, also prevent effective compressions. If the victim is found face down, roll him or her as a unit, without twisting the neck or back. A victim who must be dragged from a tight space can be pulled by the arms or legs along the long axis of the body. Remove clothing if it interferes with compressions.

***Responder Positioning and Hand Placement***
Kneel at the victim's side in a position that allows you to perform both chest compressions and rescue breathing without repositioning. For chest compressions position yourself over the victim with your shoulders directly over your hands so that the thrust of each compression is straight down on the victim's sternum (breastbone). Your arms should be as straight as possible. Use your body weight, not arm strength, to achieve proper depth.

Place your hands in the center of the chest on the lower half of the sternum. To locate the proper area for hand placement:

1. Place the heel of one hand in the center of the chest between the nipples.
2. Place the heel of the other hand on top of the first.
3. Extend or interlace fingers to keep them off the chest.

Keep your hands above the tip of the sternum.

***Chest Compression Technique***
Perform chest compressions hard and fast; minimize interruptions and allow for full chest recoil between each compression. Use the following techniques:

**Rate:** The rate of chest compressions is at least 100 per minute. Students can retain the rate and tempo of chest compressions better when a metronome is used during practice.

Clapping, using the EMS Safety DVD practice chapter, an AED compression metronome or a familiar song (with 100 beats per minute) can all help responders make the muscle brain connection to achieve the correct rate of chest compressions.

**Ratio of Compressions to Breaths:** Lay responders will provide 30 compressions followed by 2 rescue breaths (30:2).

**Depth:** Compress the chest at least 2 inches for an adult victim.

**Minimize Interruptions:** The goal of chest compressions is to force oxygenated blood to the heart and brain. It takes several compressions to build up enough blood pressure and increase cardiac output to the point where the brain and heart are being oxygenated.

When compressions are interrupted, the blood pressure drops much faster than it builds. Interruption of chest compressions is a lot like trying to blow up a leaky balloon. As soon you stop blowing, the air rushes out and you have to start all over from the beginning. Interruptions to compressions drop blood pressure and reduce cardiac output; the brain and heart are not receiving oxygen until the 'balloon' is full again.

**Full Recoil** Allowing the chest to fully expand between each compression is as important as the depth of compression for maximizing blood flow with CPR. Often a responder who is fatigued may lean on the chest. The responder needs to take his or her *full weight* off the victim's chest while maintaining hand-to-chest contact. Restricting full recoil reduces cardiac output and makes compressions less effective.

***Common Mistakes: Compressions***

1. Crisscrossing hands: Keep hands parallel so the force of compressions goes through the heel of the hands.
2. Improper hand placement: Use the center of the chest between the nipples (adult, child). Keep hands off lowest portion or tip of sternum (xiphoid process). Lift fingers off chest wall.
3. Compressions from the side: Rocking back and forth. Instruct students to compress straight up and down (like a piston) with shoulders over hands.
4. Bent arms: Keeping arms straight and using body weight rather than arm strength (bent arms) reduces fatigue.
5. Too shallow: Most responders don't press hard enough. Instruct students to compress harder, at least 2 inches for adults.
6. Too fast or too slow: Using a metronome, clapping or a familiar song (100 beats/min) during practice helps students learn and retain the correct compression rate.
7. Not enough recoil: Remove all weight from the chest between compressions but keep hands in contact with the chest.
8. Bouncing compressions: Students may try to achieve full recoil by bouncing. Instruct students to lift all body weight off the chest between each compression while maintaining hand contact with the chest.

**A: Airway**

After 30 compressions, open the airway quickly and efficiently by tilting the head back and lifting the chin. It should not take more than a few seconds to position the head for rescue breaths.

The tongue is the most common cause of airway obstruction when an unresponsive victim is on his or her back. When it relaxes, the tongue falls into the back of the throat, blocking the passage of air. Tilting the head and lifting the chin moves the tongue out of the way of the trachea, allowing air to flow.

***Head Tilt/Chin Lift***

The head tilt/chin lift method is the preferred way for a lay responder to open the airway of an injured or non-injured victim.

1. Place one hand on the victim's forehead.
2. Place 2 or 3 fingers of your other hand near the chin.
3. With the hand on the forehead, apply firm, backward pressure with your palm, tilting the head back.
4. While tilting the head, use the fingers of the other hand to lift the jaw upward to bring the chin forward and the teeth almost to occlusion.

Keep your fingers on the bony part of the jaw. **Do not** press deep into the tissue under the chin. **Do not** use your thumb to lift the chin.

If the victim wears dentures, the head tilt/chin lift will help keep loose dentures in place, creating a better seal around the mouth. Remove the dentures if they cannot be kept in place.

***No Jaw Thrust for Lay Responders[3]***

Lay responders are not taught the jaw thrust technique. It is difficult to teach and learn. Often, attempting a jaw thrust creates more neck movement with poor airway management. Lay responders are usually able to use the head tilt/chin lift more effectively and safely than the jaw thrust, even for victims with suspected spinal injury. The jaw thrust technique is only taught to professional responders.

**B: Breathing**

After 30 compressions, quickly open the airway and provide two rescue breaths, then immediately resume compressions.

The oxygen that remained in the victim's body in the moments following SCA will need to be replaced through rescue breaths. The exhaled air from rescue breaths contains enough oxygen to keep a victim alive for a short time.

Rescue breaths should be delivered carefully; provide just enough air to see a visible chest rise. **Do not** over-inflate the lungs. **Do not** breathe too hard or too fast. Excessive breaths (over-inflation of the lungs) causes gastric inflation which leads to vomiting, reduces cardiac output by decreasing the venous return to the heart, and can reduce the odds for survival of SCA.[3]

***Avoid Over-Inflation of the Lungs***

1. About 1 second each breath

2. Visualize the chest during each breath. When the chest begins to rise, stop.
3. Take a regular-sized breath, not deep, to fill your lungs. Regular breaths reduce over-inflation of the victim's lungs and decrease dizziness or lightheadedness of the responder.

***Steps for Rescue Breaths: Mouth-to-Mouth***

1. Maintain an open airway with a head tilt/chin lift.
2. Pinch the victim's nose.
3. Inhale a regular-sized breath.
4. Seal the victim's mouth with yours.
5. Breath into the victim's mouth, approximately one second.
6. Look for chest rise.
7. Break the seal by lifting your mouth off the victim's mouth.
8. Repeat for a second breath.
9. Immediately resume compressions after two breaths.

It should take no more than 10 seconds to stop compressions, deliver 2 rescue breaths, and resume compressions.[3]

If you are unable to deliver the first breath, reposition the head and reopen the airway, then attempt a second breath. If the breath still does not enter (no chest rise) after repositioning, immediately resume chest compressions.

***Common Mistakes: Rescue Breaths***

1. Head Tilt/Chin Lift: Not enough head tilt will block the adult's airway.
2. Failure to pinch the nose: Air will come out of the nose and not enter the lungs. Pinch the nose during rescue breathing.
3. Not creating a seal: Press your lips firmly on the victim's lips.
4. Not visualizing chest: Look toward the chest to see it rise with rescue breaths.
5. Over-inflation of lungs: Watch for chest rise.
6. Multiple attempts at repositioning: If the chest doesn't rise, attempt to reposition only once, then proceed to chest compressions.

**C-A-B Sequence: Adult Victim**

1. Check response (tap and shout). If no response:
2. Call 9-1-1, get the AED (send a bystander if available)
3. Check for breathing. If no breathing or only gasping:
4. **C**-A-B: 30 Compressions
5. C-**A**-B: Open Airway (head tilt/chin lift)
6. C-A-**B**: 2 Breaths
7. Repeat cycles of Compressions and Breaths

## CPR Barriers

CPR barriers are small, portable devices that are designed to help prevent the transmission of disease during rescue breathing by providing a barrier between the

victim and the responder. Although barrier devices have not been proven to decrease the risk of infection transmission, responders are encouraged to carry a CPR barrier device with them. The risk of acquiring an infection while performing CPR is very low, but the use of a barrier device may overcome a responder's hesitation to provide rescue breathing.[3]

CPR barrier devices are small enough to be carried on a key chain, in a first aid kit, glove compartment, desk drawer, purse or briefcase, golf or gym bag, or even a pocket. They come with various features, and can be broken down into two major categories: face masks and face shields.

**Face Mask**

The CPR face mask is a transparent, molded, mask-like plastic piece designed to fit over the mouth and nose of a victim. Some face masks have a two-way valve that diverts the victim's exhaled air away from the responder. Most have a one-way valve that will require the mask to be lifted off the victim's face between breaths and during chest compressions. Some face masks come with an oxygen inlet allowing for the use of supplemental oxygen.

***Proper Fit of the Face Mask***

To be effective the face mask needs to fit properly to create a seal. Masks that are too big or too small will not work. The face mask fits properly when:

- The narrow top of the mask does not extend past the bridge of the nose.
- The wide bottom of the mask does not extend past the chin.

***Using a Face Mask***

The responder is positioned at the side of the victim in the same location as CPR with mouth-to-mouth rescue breaths.

1. Apply the mask to the victim's face and create a seal.
    a. Place the thumb and index finger of your upper hand (closest to the top of the victim's head) along the upper border of the mask.
    b. Place the thumb of your lower hand on the lower border of the mask, and the remaining fingers along the chin and bony part of the jaw.
2. Perform a head tilt/chin lift while lifting the jaw.
3. Pull the face into the mask and press firmly to maintain the seal.
4. Breathe into the mask for 1 second; observe for chest rise.
5. Break the seal if needed to let air escape the lungs.

**Face Shield**

A CPR face shield is a waterproof plastic shield that usually contains a built-in one-way valve and/or filter. The advantage to using a face shield is that it is smaller and more portable than the face mask, and is therefore more likely to be on or near a responder at the time of an emergency that requires rescue breathing.

***Using a Face Shield***

1. Place the opening (filter or valve) over the mouth of the victim.

    a. If a valve is present, position it in the victim's mouth, between the teeth.
2. Open the airway with a head tilt/chin lift, pinch the victim's nose closed, and seal your mouth over the valve or filter of the face shield.
3. Breathe into the shield for 1 second, and observe for chest rise with each breath.
4. Allow the victim's exhaled air to escape between the shield and the victim's face by lifting your mouth off the shield between each breath.

## Adult CPR[5]

### Introduction

In the adult population, the cause of cardiac arrest is usually heart-related. Early and effective chest compressions and early AED use are critical actions that give adult victims the best chance of survival.

In any emergency situation, such as the witnessed sudden collapse of an adult, it is easy for the responder to feel overwhelmed. Breaking the CPR sequence into smaller parts makes the techniques easier to learn and more likely to be performed successfully in a real emergency. This section will teach how to perform adult CPR using the C-A-B sequence.

### Defining the Adult Victim

For the purpose of CPR, the adult victim is anyone who shows signs of puberty: underarm or facial hair for males, and breast development for females.

### Adult CPR Using the C-A-B Sequence

1. Check response
    a. Tap and shout.
    b. If no response:
2. Activate EMS and get an AED, if one is nearby.
    a. Yell for help.
    b. Send a bystander to call 9-1-1 if available.
3. Check for breathing.
    a. Turn the victim face up if needed.
    b. Scan the chest for breathing for 5-10 seconds.
    c. If no breathing or only gasping, begin CPR.
4. **C**-A-B: 30 Compressions
    a. Position: Face up on a firm, flat surface.
    b. Location: 2 hands in the center of the chest between the nipples.
    c. Rate: At least 100/minute
    d. Depth: At least 2" down
    e. Allow full chest expansion between compressions.
5. C-**A**-B: Open Airway
    a. Use the head tilt/chin lift to open the airway.

6. C-A-**B**: 2 Breaths
    a. Give 2 rescue breaths for about 1 second each.
    b. Watch for chest rise.
    c. Do not over-ventilate.
7. Repeat cycles of 30 Compressions and 2 Breaths.
    a. After 2 breaths, immediately resume compressions.
    b. Minimize interruptions.
    c. Take no more than 10 seconds to stop compressions, give 2 rescue breaths, and resume compressions.

## Child CPR[4]

### Introduction

The techniques of Child CPR are slightly different than those for adults due to physical differences and also a difference in the usual cause of cardiac arrest.
Cardiac arrest in a child usually results from respiratory arrest, not from a cardiac problem. Common causes include injury, poisoning, choking, drowning, and asthma. It's important to recognize and react to the signs of a child in distress before it leads to cardiac arrest.

Child and Infant cardiac arrest victims typically need CPR before defibrillation. This is why responders who are alone will provide 2 minutes of CPR before leaving to activate EMS.

Chest compression techniques are also different. The depth of compressions for a child victim is 1/3 the depth of the chest, or about 2 inches. A responder may use 1 or 2 hands to perform compressions.

### Defining the Child Victim

For the purpose of CPR, the child victim is anyone from age 1 to just before puberty. If the child shows signs of puberty (underarm or facial hair for males, and breast development for females), treat the victim as an adult.

### Child CPR Using the C-A-B Sequence

1. Check response
    a. Tap and shout.
    b. If no response, yell for help.
    c. Send a bystander to call 9-1-1 if available.
2. Check for breathing.
    a. Turn the victim face up if needed.
    b. Scan the chest for breathing for 5-10 seconds.
    c. If no breathing or only gasping, begin CPR.
3. **C**-A-B: 30 Compressions
    a. Position: Face up on a firm, flat surface.

   b. Location: 1 or 2 hands in the center of the chest between the nipples.
   c. Rate: At least 100/minute
   d. Depth: About 2” down
   e. Allow full chest expansion between compressions.
4. C-**A**-B: Open Airway
   a. Use the head tilt/chin lift to open the airway.
5. C-A-**B**: 2 Breaths
   a. Give 2 rescue breaths for about 1 second each.
   b. Watch for chest rise.
   c. Do not over-ventilate.
6. Repeat cycles of 30 Compressions and 2 Breaths.
   a. After 2 breaths, immediately resume compressions.
   b. Minimize interruptions.
   c. Take no more than 10 seconds to stop compressions, give 2 rescue breaths, and resume compressions.
7. Activate EMS and get the AED.
   a. If you are still alone after 5 cycles of CPR (about 2 minutes), stop CPR to go activate EMS and get an AED, if one is close by.
   b. Return quickly and resume CPR until EMS arrives or the child begins to move.
8. If EMS is already activated, provide continuous cycles of 30:2.
9. Use an AED as soon as it is available.

**Note:** When performing chest compressions with one hand, do not use the free hand to hold the airway open. Rest it on the floor. Attempting to open the airway while compressing the chest may cause injury to the head or neck.

## Infant CPR[4]

### Introduction

The techniques for Infant CPR are slightly different than those for child and adult CPR.

Cardiac arrest in an infant also usually results from respiratory arrest. Common causes include injury, choking, SIDS, and respiratory illness. Recognize and react to the signs of an infant in distress before it leads to cardiac arrest.

The depth of compressions for an infant victim is 1/3 the depth of the chest, or about 1 ½ inches. A responder will use 2 fingers to compress the chest. Open the airway to neutral. During mouth-to-mouth rescue breathing, the responder covers the infant’s *mouth and nose*.

### Defining the Infant Victim

For the purpose of CPR, the infant victim is up to 1 year old, based on body weight and size.

**Infant CPR Using the C-A-B Sequence**

1. Check response
    a. Tap the bottom of the foot and shout.
    b. If no response, yell for help.
    c. Send a bystander to call 9-1-1 if available.
2. Check for breathing.
    a. Turn the infant face up if needed.
    b. Scan the chest for breathing for 5-10 seconds.
    c. If no breathing or only gasping, begin CPR.
3. **C**-A-B: 30 Compressions
    a. Position: Face up on a firm, flat surface.
    b. Location: 2 fingers in the center of the chest, just below the nipple line.
    c. Rate: At least 100/minute
    d. Depth: About 1 1/2 inch down
    e. Allow full chest expansion between compressions.
4. C-**A**-B: Open Airway
    a. Use the head tilt/chin lift to open the airway.
    b. Only open the airway to neutral. Overextending the neck may actually close block airway.
5. C-A-**B**: 2 Breaths
    a. Give 2 rescue breaths for about 1 second each.
    b. Cover the *mouth and nose* with your mouth.
    c. Watch for chest rise.
    d. Do not over-ventilate.
6. Repeat cycles of 30 Compressions and 2 Breaths.
    a. After 2 breaths, immediately resume compressions.
    b. Minimize interruptions.
    c. Take no more than 10 seconds to stop compressions, give 2 rescue breaths, and resume compressions.
7. Activate EMS.
    a. If you are still alone after 5 cycles of CPR (about 2 minutes), stop CPR to go activate EMS.
    b. Bring the infant to the phone if not injured or too heavy.
    c. Return quickly and resume CPR until EMS arrives or the infant begins to move.
8. If EMS is already activated, provide continuous cycles of 30:2.

## Special Consideration: CPR

**Electrical Shock**

Because our circulatory and respiratory systems work on electrical signals from the brain and heart, exposure to an electrical shock or lightning strike can result in respiratory or cardiac arrest.

When dealing with the victim of an electrical shock, your own safety is the primary concern. Electricity can easily travel from the victim to the rescuer with direct contact. Before rendering aid, make sure that the power source has been shut down and the victim is not touching the power source. Turn off the fuse box or unplug the appliance. In cases where the victim is outside, the power company may have to be called.

**Cold Temperatures**

During the instruction of CPR, we teach rescuers that brain damage will begin four to six minutes after the victim's breathing and circulation have stopped. In a cold environment, however, this time frame may be extended. Situations that involve hypothermia and/or cold water drowning may provide rescuers with more time to oxygenate the brain.

Do not assume it's too late to start CPR when in a cold environment. A common saying among professional rescuers who work in the cold is, "A person isn't dead until they're warm and dead."

***Hypothermia***

Hypothermia occurs when a person's body temperature falls below the normal functioning range and the body loses more heat than it produces. In hypothermic situations the body's metabolism (the breakdown and use of stored energy and creation of waste product) slows down, reducing the need for oxygen.

The result of hypothermia is that brain cells take longer to die. In a cold environment CPR can be started later than normal with less risk of brain damage or death. If the victim is not breathing, begin CPR immediately. If the victim is responsive, gently remove him or her from the cold environment, remove damp clothing, dry and insulate. Activate EMS.

***Drowning***

Similar to hypothermia, cold water drowning can extend the amount of time for CPR. In 1974 a case was documented in which a victim was submerged for over 40 minutes, removed from the water, declared dead, and then started to breathe on the way to the morgue. He fully recovered. There have been many cases since then in which the cold water delayed or prevented the onset of brain damage or death.

Remove the victim quickly from the water, but pay attention to your own safety. Once the victim is removed from the water, begin CPR immediately. If the rescuer has special training, rescue breathing can be started while the patient is still in the water. Mouth-to-nose rescue breathing may be easier while in the water than mouth-to-mouth.

In some cases the drowning is termed a "dry drowning" because laryngospasm occurred, preventing water from entering the lungs. If the person did aspirate water,

there is still no need to clear the airway of water because it will not act as an obstruction in the airway.

Studies have shown that vomiting is frequently associated with drowning. If the victim vomits during CPR, log roll him or her to the side, remove the vomitus with your finger, then return the victim to supine to continue CPR.

**Vomiting During CPR**

A person in cardiac arrest will often vomit. Vomiting is not a sign of circulation; it only means that trapped air escaped the stomach. Vomiting can lead to aspiration and infection.

If the victim vomits during CPR, quickly but carefully turn the victim's body to the side, clear the mouth by wiping out any foreign contents with your finger, return the victim to the supine position (on the back) and continue CPR.

Try to prevent vomiting by providing just enough air to make the chest rise during rescue breaths (not over-ventilating). Be prepared for vomiting by knowing what to do and using proper personal protective equipment.

**Cardiac Arrest in a Pregnant Person**

When treating a pregnant victim, you may need to accommodate the person's physiological differences.

- A pregnant victim may have an elevated diaphragm due to the increased abdominal contents. Hand placement for chest compressions should be slightly higher on the sternum, just above the center, to accommodate the diaphragm and abdominal contents.
- The recovery position should be on the person's left side to improve circulation.
- Use an AED if indicated. Saving the mother is the best chance of saving the fetus.

**CPR Alternatives**

There are alternatives to traditional CPR methods that may benefit a cardiac arrest victim, depending on the circumstances of the emergency.

***Compression-Only CPR[72]***

The lay responder should feel confident that he or she can perform both compressions and ventilations. Untrained responders and those who are unable or unwilling to give rescue breaths should perform chest compressions without rescue breaths. This is called Compression-Only CPR, or Hands-Only CPR™ by the American Heart Association.

To do Compression-Only CPR, provide continuous chest compressions at a rate of at least 100 per minute without pausing. The victim will receive oxygen as compressions force air in and out of the lungs.
After the witnessed collapse of an adult victim:

1. Call 9-1-1.
2. Place hands in the center of the chest.
3. Push HARD and FAST, at least 100 times per minute.

Compression-only CPR is for the witnessed sudden collapse of an **adult** victim. **It is not to be used for children or infants, or for adults with cardiac arrest due to suffocation (e.g. drowning).** Children, infants, and adult victims of suffocation require rescue breaths to improve the odds for survival.

***Mouth-to-Nose Rescue Breathing***

A rescuer may use mouth-to-nose rescue breathing for the following reasons: inability to open the victim's mouth; serious injury to the mouth; and when a tight seal around the mouth is difficult to obtain.

**Drowning Victims and Mouth-to-Nose Rescue Breathing:**[70] During drowning situations, rescuers may benefit from the use of mouth-to-nose breathing while the victim is still in the water. Responder's hands are often occupied with supporting the victim's head and shoulders, making a chin lift difficult. If the rescuer has special training, mouth-to-nose breathing can be started immediately after the victim's head comes out of the water. Otherwise, remove the victim from the water as quickly as possible and begin CPR. Do not attempt compressions in the water.

**To provide mouth-to-nose breathing:**

1. Open the airway.
2. Close the victim's mouth.
3. Breathe into the nose, sealing your lips around the victim's nose.
4. Lift your mouth from the victim's nose to allow passive exhalation.
5. Open the victim's mouth periodically to allow free exhalation.

***Mouth-to-Stoma Breathing***

Rescuers should use mouth-to-stoma breathing when a person has a tracheostomy (a surgical opening at the neck used for breathing) and needs rescue breathing. A tracheostomy tube is used to maintain a clear stoma. If the tracheostomy tube is obstructed and cannot be cleared, it will need to be removed.

## To provide mouth-to-stoma breathing:

1. Seal your mouth over the stoma.
2. Breathe into the stoma; observe for chest rise.
3. Lift your mouth from the victim to allow passive exhalation.

4. If necessary, apply a face mask or seal the victim's mouth and nose to prevent significant air escape.

### When to Stop CPR

Adult CPR is repeating the C-A-B sequence over and over. Repeat the sequence of compressions, airway, breathing as long as possible.
Stop CPR if:

1. The victim begins to move, moan or respond.
2. Help arrives and is ready, by your side, to relieve you.
3. An AED is attached and prompts you to stop CPR.
4. You are exhausted and unable to continue.
5. The airway is blocked by a visible obstruction. Remove the obstruction or roll the victim to the side and clear the airway, then resume CPR.
6. The scene becomes unsafe

## Complications from CPR

Complications can occur during CPR, even when it is performed correctly.

### Complications Associated with Chest Compressions

Complications from chest compressions may include a fractured sternum or separation of the ribs from the sternum. When a rib breaks it may cause other problems internally, such as a punctured lung or perforated liver.

Do not let the risk of injury to the victim impede prompt and vigorous CPR; the alternative to CPR is death. If a rib fractures, do not stop or reduce CPR efforts. Recheck hand position and continue CPR.

To minimize rib and internal injury resulting from chest compressions, rescuers should ensure proper placement of the hands and positioning of the rescuer. Remain directly over the victim; maintain contact with the chest (i.e. no bouncing compressions).

It should be noted that these types of injury rarely occur in children and infants, who have softer and more flexible bones than adults.

### Complications Associated with Rescue Breathing

Complications from rescue breathing usually result from gastric inflation – air entering the stomach. When air enters the stomach during rescue breathing, it becomes trapped and the stomach begins to fill as more air is introduced.

Gastric inflation causes regurgitation (vomiting), aspiration (foreign matter enters the lungs, possibly leading to infection), pneumonia, decreased venous return, and decreased lung capacity due to the distended abdomen elevating the diaphragm.

Reduce the risk of exposure by being prepared with PPE, including a CPR barrier mask, in case the victim vomits.

The usual cause of complications from rescue breathing is improper chin and head positioning. If air doesn't enter the lungs, avoid forcing air; reposition the airway one time and give a 2nd breath. If the second breath does not cause the chest to rise, resume compressions.

If there is gastric inflation, do not attempt to manually relieve the distention of the abdomen, as this will almost certainly cause vomiting.

## Two Rescuers: Lay Responder[70]

When two rescuers are present, one should go activate EMS and get an AED, if available, while the other begins CPR. After returning from activating EMS, the second rescuer should be ready to relieve the first.

CPR is hard work. After only a couple minutes of continuous CPR, the rescuer will be tired and out of breath. Studies have shown that compression rate and depth decrease with rescuer fatigue. If there is a second trained rescuer, he or she may rotate performing CPR and observing every 2 minutes. The rescuers should be positioned on opposite sides of the victim.

Although two trained rescuers can effectively share the tasks of CPR, with one providing rescue breaths and the other performing compressions, it requires practice and coordination. It is easier and often more effective for lay providers to relieve one another rather than perform 2-rescuer CPR. Professional rescuers and health care providers are trained to provide 2-rescuer CPR.

# CPR/AED Overview

## Chain of Survival[3]

The purpose of this topic is to demonstrate the stark realities of cardiac arrest in the United States and the importance of how a coordinated response can increase the odds for surviving a cardiac arrest.

### Clinical vs. Biological Death

The first few minutes of cardiac arrest is where the trained bystander can make the difference between life and death. People who suffer cardiac arrest, especially SCA, need rapid intervention to restore oxygen flow to the brain or brain cells will begin to die. After 4–6 minutes of cardiac arrest, the brain will suffer permanent, irreversible brain damage. After 10 minutes without oxygen the brain is dead. **The goal of bystander CPR is to restore oxygen flow to the brain and sustain life until professional help arrives**.

When cardiac arrest occurs, the victim is clinically dead. Clinical death is reversible. Brain death (the death of all brain cells), also known as biological death, usually occurs within 10 minutes of cardiac arrest if effective CPR is not started. Biological death is irreversible.

## Increasing the Odds

There are five critical interventions to increase the cardiac arrest victim's chance of survival. Delays in initiating care or between each step decrease a person's chance of surviving a cardiac arrest. The key concept you will teach your students is early intervention. Early intervention saves lives.

1. **Activate EMS:** Recognize cardiac arrest and activate the Emergency Medical Services (EMS) by dialing an emergency number. In most communities the number to dial is 9-1-1. If a person is unresponsive to a shout and tap, teach your students to instruct a bystander to quickly call 9-1-1, get the AED and return to you. If your student is alone with an adult victim, teach him or her to go call 9-1-1, get the AED and return.
    - The dispatcher will gather the information and simultaneously be routing the appropriate emergency personnel to the scene.
    - The call will only take a few moments.
    - Teach your students to be prepared to give their name, location and the nature of the emergency, and always hang up last.
    - 9-1-1 operators can help provide instructions to the bystander.

2. **Early CPR:** Basic Life Support, or BLS, is a term referring to CPR. The earlier BLS care is delivered, the better the odds of survival. Properly performed CPR, when initiated immediately after cardiac arrest, can reduce loss of brain cells, sustain life until trained professional help arrives, and increases the chance of successful defibrillation.

3. **Early Defibrillation:** Early defibrillation is critical to surviving sudden cardiac arrest, especially in the adult patient. In previous years bystanders relied on the arrival of the paramedics to provide life saving electrical shocks known as defibrillation. Today, lay rescuers can provide defibrillation with an AED before the arrival of EMS personnel, giving the victim the best chance of survival.

4. **Early Advanced Care:** By calling 9-1-1 early, the bystander can initiate the next link in the chain of survival. EMS responders trained in Advanced List Support (ALS) can provide advanced airway management and drug therapy in addition to CPR on the scene and en route to the hospital. The effectiveness of ALS depends on high-quality BLS.

5. **Post-Arrest Care:** Once the heart is beating and stabilized, doctors, nurses, therapists, and many others will continue to provide care to improve the chance of continued survival with the least amount of disability.

## Pediatric Chain of Survival

The chain of survival is slightly different for children, since the cause of cardiac arrest is usually related to respiratory arrest. The pediatric chain of survival emphasizes prevention and chest compressions.

1. Prevention of Arrest
2. Early CPR
3. Activate EMS
4. Early Advanced Care
5. Post-Arrest Care

## Anatomy and Physiology

The cardiovascular system is comprised of the heart, blood vessels and blood. It is responsible for the delivery of oxygen to the cells. The heart is the main pump in the body. Arteries are vessels that transport blood away from the heart to the tissues, while veins carry blood back to the heart. As the blood circulates, oxygen is exchanged for carbon dioxide, which is transported out of the body through the interaction of the cardiovascular and respiratory systems.

The heart is a hollow organ responsible for moving blood throughout the body. It is about the size of your fist and is located in the center of your chest behind your breastbone. The coronary arteries provide a fresh supply of oxygenated blood to the heart muscle to keep it alive.

The heart is divided into four chambers. The chambers on top are the right and left atria, and the chambers on the bottom are the right and left ventricles. The septum is a thick muscle wall that separates the right and left sides of the heart.

When electrically stimulated, the atria contract and pump blood from the top of the heart to the ventricles below. The ventricles contract and pump blood to the body

tissues. First the atria pump, followed by the ventricles. The pumping action of the heart is controlled by the electrical conduction system (pacemakers) of the heart.

The right atrium receives deoxygenated blood from the body and pumps it into the right ventricle. From the right ventricle the deoxygenated blood is pumped into the lungs. As we exhale we blow off carbon dioxide, a waste product. Inhalation brings fresh oxygen to the lungs. From the lungs the freshly oxygenated blood is pumped into the left atrium, down into the left ventricle, through the aorta to the body.

**The Electrical Conduction System of the Heart**

All muscular movement in the body is stimulated by electrical impulses. The brain sends impulses down the spinal cord and through the nerves, which causes individual muscles to contract. The heart, however, is unique. Its electrical impulses originate from within and it doesn't rely on the brain for stimulus to beat. The electrical impulses are generated by a series of specialized cells called pacemakers.

The chief pacemaker of the heart is the sinoatrial node (SA node), located in the right atrium. The SA node is a group of specialized muscle cells that creates electrical impulses at a specific rate. These impulses are conducted down the fibers of the heart's specialized conducting system, from the top to the bottom of the heart. As the electrical impulse travels, it stimulates the heart muscle to contract, creating a heartbeat and moving oxygenated blood throughout the body.

Other pacemaker cells in the heart can take over the work of pacing (stimulating) the heart's pumping action. If the chief pacemaker fails, the heart can continue to pump because of these back-up pacemakers.

**Ventricular Fibrillation**

During a heart attack the heart muscle is deprived of oxygen. Cardiac cells in the affected area become irritated from the decreased supply of oxygen. Pacemaker cells also become irritable and premature contractions begin to occur, further depleting the oxygen supply to the heart.

As the heart works harder to obtain more oxygen, it demands more oxygen to compensate for the increased workload. More oxygen demand means more electrical impulses. As the heart is overloaded with electrical impulses, it may go into a lethal rhythm known as ventricular fibrillation.

During ventricular fibrillation the heart is overwhelmed by chaotic electrical impulses. The heart quivers or twitches erratically instead of following its normal pumping action. The heart stops beating and the person becomes unresponsive due to a lack of oxygen to the brain.

## CPR Overview

CPR is an abbreviation for Cardiopulmonary Resuscitation. When a person suffers cardiac arrest, CPR is used to restore blood flow to the brain. The goal of CPR is to provide oxygen to the brain to keep it alive until normal breathing and heartbeat return. Bystander CPR, when performed early and correctly, is critical to survival of cardiac arrest. Among cardiac arrest victims treated by EMS, only 31% received bystander CPR![69]

CPR combines external chest compressions with rescue breathing to provide oxygen to the brain after a cardiac arrest has occurred. During CPR the rescuer becomes the victim's heart and lungs. The rescuer breathes into the victim's mouth to pass air into the lungs so that oxygen can enter the bloodstream. The fresh oxygen is circulated to the brain when external chest compressions replace the pumping action of the heart.

A common question during CPR is, "How can I exhale carbon dioxide (CO2) and still be able to provide oxygen to a victim in need?" The answer boils down to simple math. The air we breathe consists of many types of gases; 21% of it is oxygen. Our body uses only about 5% of the oxygen we inhale. Our exhaled air contains approximately 16% oxygen. This percentage is enough to sustain life.

The air is passed from the mouth through the trachea (windpipe) down into the lungs. External chest compressions squeeze the heart between the sternum (breastbone) and the spine. Chest compressions force the blood from the heart to the lungs, where it picks up oxygen. The oxygenated blood is delivered to the brain through continuous chest compressions.

As pressure on the chest is released, the heart fills with more blood (passive filling) for the next compression. It is important to note that CPR is only about 30% as effective at delivering oxygenated blood when compared to the normal, beating heart. For rescuers this means that extended CPR times, without the return of normal circulation, provides dismal outcomes.

To optimize the benefits of CPR, it must be performed on a firm, flat surface. Compressions must be performed at the proper rate and depth, and with adequate force. Prolonged pauses between cycles of compressions (e.g. taking too much time for rescue breaths) allows the blood flow produced by the compressions to slow and reduces oxygen delivery to the brain and heart. This decreases the survival rate.[3,69] If compressions are not performed correctly, with minimal interruptions, and on a firm enough surface, CPR will not be effective.

## AED Overview

CPR can keep the brain alive for a short time after cardiac arrest, but it will not restore a heartbeat in an adult victim of sudden cardiac arrest. A shock from a

defibrillator is needed to restore a normal heart rhythm. CPR keeps the brain alive while EMS is activated and paramedics rush a defibrillator to the scene.

The defibrillator shocks the heart with electricity to momentarily stop the chaotic electrical impulses and help it resume normal electrical conduction and, hopefully, pumping. CPR provided immediately after collapse increases the likelihood that defibrillation will be effective, and can significantly increase a victim's chance of survival. If bystander CPR is not provided, an SCA victim's chance of survival decreases 7-10% for every minute that passes without a shock from a defibrillator.[69]

An AED is a small, portable defibrillator brought to the scene and used by lay providers prior to the arrival of EMS. Reducing the time between cardiac arrest and defibrillation dramatically increases the effectiveness of defibrillation and provides the victim with the best chance to live.

The AED is a sophisticated tool that is easy to use. It assesses the cardiac rhythm of an unresponsive victim and determines if a shock is needed. If needed, the user is prompted by a series of voice and on-screen commands to provide a shock.

The heart rhythm analysis and electrical shock are delivered through electrode pads that are placed on the victim. By attaching the adhesive pads to the victim's bare chest, then connecting them to the AED, the rescuer provides the connection that the AED needs to begin its analysis of the cardiac rhythm (the electrical activity of the heart). The AED sends the signal of the electrical activity of the heart through the electrodes to a microprocessor that records and analyzes the cardiac rhythm to determine if it is consistent with VF or other shockable rhythms. If a shock is needed, it is delivered from the AED, through the electrodes, and into the victim.

Most AEDs operate under the same principles. If a defibrillation is needed, the AED prompts the rescuer to prepare for defibrillation while it charges up. The AED delivers a rapid, powerful electrical current through the heart. The powerful current creates a pause of the overloading electrical activity in the heart, giving a chance for the normal cardiac rhythm to take over and restore the pumping action.

The AED requires the user to attach electrodes to the victim. Most AEDs require the user to turn on the unit, connect the electrodes to the AED, and press the shock button when instructed. Some AEDs power up automatically when the case is opened, and the electrodes come pre-connected to the unit. Other AEDs are fully automatic and will shock without the push of a button once a shockable rhythm is detected.

Defibrillation within 3-5 minutes of collapse will produce the highest survival rates. When placed in the hands of lay rescuers, trained workplace responders, security officers and law enforcement, AEDs reduce the time to defibrillation, increasing

survival rates. The time from collapse to defibrillation, in conjunction with bystander CPR, are the most important determinants of survival from cardiac arrest.

AEDs are often made available to the public through Public Access Defibrillation (PAD) programs sponsored by many municipalities. AEDs are commonly seen in police cars, at airports, stadiums, sporting events, shopping malls, golf courses, schools, and other public venues. Although the widespread use of AEDs in the U.S. could save numerous lives each year, only about 2% of cardiac arrest victims have an AED applied by a lay responder before EMS arrives.[69]

# Dental Emergencies

## Overview[75]

Dental trauma is extremely common. Five million teeth are knocked out each year. Dental emergencies may include a fractured, loosened or displaced tooth, or **avulsed** (knocked out of the socket) tooth. Most dental trauma occurs in children and is preventable. Use mouth guards and face shields when appropriate during sports to significantly reduce the incidence of injury. When driving, always wear a seat belt and ensure that young children are in a car seat. Do not chew ice, hard candy, or popcorn kernels, as they can crack a tooth.

## Knocked-out Permanent Tooth[76,77,78,23]

While a baby tooth does not need to be put back in, fast action is critical to save an avulsed permanent tooth. If a tooth is quickly placed back in its socket with minimal handling, it is usually retained permanently. If reimplantation is delayed, the success rate for long-term retention drops, and root resorption usually occurs. Ideally, **a patient should see his or her dentist within 30 minutes of an injury**, one hour at the longest.

A person with an avulsed tooth should not try to reinsert it back in the socket him or herself. A consensus of medical experts has determined that the potential harm from attempting to reinsert a tooth exceeds the potential benefit.

**Treatment:**

1. Handle the tooth by the crown (biting edge), not the root.
2. Rinse the tooth gently in water if dirty, but do not scrub it. Touching or cleaning the root could remove periodontal ligament fibers and reduce the chance of successful reimplantation.
3. Cleanse the bleeding wound with clear water or saline.
4. Place the tooth in a container of cool milk, or water if milk is unavailable. DO NOT let the tooth dry out.
5. Bite down on a sterile gauze pad or clean cloth to control bleeding.
6. Apply an ice pack wrapped in a moist cloth to the face near the injury.
7. See a dentist within 30 minutes, or one hour at the longest, to replant the tooth. The longer the tooth is out of the mouth, the less likely it can be saved.
8. Remain alert for signs of airway compromise due to blood or broken teeth.

If an avulsed tooth is lost, the patient should have a chest x-ray to determine if the tooth was aspirated (inhaled) or swallowed. A patient may also require antibiotics and a tetanus shot.

## Broken or Loose Tooth

1. A **broken or chipped tooth** should be held in place with sterile gauze until you can contact your dentist. Locate and save any broken tooth fragments.
2. A **loose or displaced tooth** should be gently repositioned without forcing the tooth. Stabilize the tooth by biting down.

3. Rinse your mouth with warm water.
4. Apply an ice pack wrapped in a moist cloth to reduce swelling.
5. Contact your dentist immediately.
6. Avoid drinking or eating until you have consulted the dentist.

## Toothache:[79]

Although not a medical emergency, a toothache can be very painful. It is usually a sign of tooth decay, and is a common problem with a long onset. A toothache can also indicate an infection. Field treatment options are limited and include rinsing the mouth with water, and removing any food trapped between the teeth with dental floss. Avoid sweets, very hot or cold liquids, and gum chewing.

Do not medicate the tooth. Placing crushed aspirin or another painkiller on a tooth may burn the gum and destroy tooth enamel. Seek care from a dentist as soon as possible.

## Jaw Injury[80,81]

A jaw fracture is suspected after trauma if there is pain on palpation, swelling, limited opening of the mouth, a new malocclusion (poor bite), irregularity in the contours of the face, diplopia (double vision), or facial anesthesia (numbness).

To reduce pain from a possible jaw fracture, close the mouth and immobilize the jaw by splinting it with gauze. If a gauze roll is unavailable, use a towel, shirt or necktie to secure the jaw. Avoid interfering with the airway and do not over-tighten. Remain alert for airway complications. Apply an ice pack wrapped in a moist cloth to the fracture site to reduce swelling. Seek professional medical attention promptly. If there is airway obstruction or uncontrollable bleeding, activate EMS.

## Bitten/Bleeding Tongue, Lip or Cheek[75]

Control bleeding by applying direct pressure to the affected area using a sterile gauze pad. Use an ice pack wrapped in a moist cloth to reduce swelling. Apply continual pressure for at least six to ten minutes. If you are unable to control or stop the bleeding after 15 minutes, activate EMS (call 911) or go to a hospital emergency room.

Observe for signs of airway compromise. Position the person so that blood is allowed to drain out of the mouth, either sitting up with the head tilted slightly down, or in the recovery position. Blood that is swallowed can irritate the stomach and cause vomiting. In the unresponsive patient, blood or teeth from a mouth injury can obstruct the airway or be aspirated.

# Diabetic Emergencies

## Overview[82,83,84,85]

Diabetes is one of the leading causes of death and disability in the United States. It is a serious, lifelong condition that is associated with long-term complications that affect almost every part of the body. The disease often leads to blindness, heart and blood vessel disease, stroke, kidney failure, amputations, and nerve damage. Uncontrolled diabetes can complicate pregnancy, and birth defects are more common in babies born to women with diabetes.

## What is diabetes?[83,84]

Diabetes mellitus is a group of diseases characterized by high levels of blood glucose. It is a disorder of metabolism – the way our bodies use digested food for growth and energy. Most of the food we eat is broken down into glucose, the form of sugar in the blood. Glucose is the main source of fuel for the body.

After digestion, glucose passes into the bloodstream, where it is used by cells for growth and energy. For glucose to get into cells, insulin must be present. Insulin is a hormone produced by the pancreas, a large gland behind the stomach.

When we eat, the pancreas automatically produces the right amount of insulin to move glucose from our blood into our cells. In people with diabetes, however, the pancreas either produces little or no insulin, or the cells do not respond appropriately to the insulin that is produced. Glucose builds up in the blood, overflows into the urine, and passes out of the body. Thus, the body loses its main source of fuel even though the blood contains large amounts of glucose.

## Statistics[82]

Almost 26 million people in the United States (8.3% of the population) have diabetes. Of those, 19 million have been diagnosed, and about 7 million people have not yet been diagnosed. Each year, about 1.9 million people aged 20 or older are diagnosed with diabetes.

- 27% of adults over age 65 has diabetes.
- Adults with diabetes have heart disease-related death rates up to 4 times higher than adults without diabetes.
- Risk of death is twice as high among people with diabetes when compared to those without diabetes.
- Diabetes is the leading cause of new cases of blindness (12,000-24,000 each year)
- Diabetes is the leading cause of new cases of blindness among those aged 20-74 years.
- Diabetes is the leading cause of non-traumatic amputations. Over 65,000 people have diabetes-related leg, foot or toe amputations each year.

## Types of Diabetes[82,83]

There are three main types of diabetes: type 1 diabetes, type 2 diabetes, and gestational diabetes.

**Type 1 diabetes** (previously called insulin-dependent diabetes mellitus, IDDM, or juvenile-onset diabetes), is an autoimmune disease. The immune system attacks the insulin-producing beta cells in the pancreas and destroys them. The pancreas then produces little or no insulin. A person who has type 1 diabetes must take insulin daily to live.

Type 1 diabetes develops most often in children and young adults, but can appear at any age. Symptoms of type 1 diabetes usually develop over a short period, although beta cell destruction can begin years earlier. Symptoms include increased thirst and urination, constant hunger, weight loss, blurred vision, and extreme fatigue. If not diagnosed and treated with insulin, a person with type 1 diabetes can lapse into a diabetic coma.

**Type 2 diabetes** (previously called non-insulin-dependent diabetes mellitus, NIDDM, or adult-onset diabetes) is the most common form of diabetes. About 90 to 95 percent of people with diabetes have type 2. This form of diabetes is associated with older age, obesity, family history of diabetes, previous history of gestational diabetes, physical inactivity, and ethnicity. Type 2 diabetes is increasingly being diagnosed in children and adolescents.

When type 2 diabetes is diagnosed, the pancreas is usually producing enough insulin, but for unknown reasons, the body cannot use the insulin effectively, a condition called insulin resistance. After several years, insulin production decreases. The result is the same as for type 1 diabetes – glucose builds up in the blood and the body cannot make efficient use of its main source of fuel.

The symptoms of type 2 diabetes develop gradually. Their onset is not as sudden as in type 1 diabetes. Symptoms may include fatigue or nausea, frequent urination, unusual thirst, weight loss, blurred vision, frequent infections, and slow healing of wounds or sores. Some people have no symptoms. Often, the only way we become aware that a person has the disease is if a problem arises.

**Gestational diabetes** develops only during pregnancy. Like type 2 diabetes, it occurs more often in African Americans, American Indians, Hispanic Americans, and among women with a family history of diabetes. Women who have had gestational diabetes have a 35 to 60 percent chance of developing type 2 diabetes within 10 to 20 years.

People with **pre-diabetes**, a state between “normal” and “diabetic,” are at risk for developing diabetes, heart attacks, and strokes. Studies show that weight loss and increased physical activity can prevent or delay the development of type 2 diabetes

among high-risk adults. Studies have also shown that medications have been successful in preventing diabetes in some population groups. About 35%, or 79 million, Americans aged 20 or older have pre-diabetes.

## Diabetes Management[83]

People with diabetes can take steps to control the disease and lower the risk of complications. Glucose, blood pressure and blood lipid control, along with preventive care for eyes, kidneys and feet, can prevent serious complications. While some control their diabetes by proper diet, others need to take medication to keep it in check. The primary goal of diabetes management is to keep blood glucose levels as close to the normal range as safely possible.

Today, healthy eating, physical activity, and taking insulin via injection or an insulin pump are the basic therapies for type 1 diabetes. The amount of insulin must be balanced with food intake and daily activities. Blood glucose levels must be closely monitored through frequent blood glucose testing.

Healthy eating, physical activity, blood glucose testing and losing excess weight are the basic management tools for type 2 diabetes. In addition, many people with type 2 diabetes require oral medication, insulin, or both to control their blood glucose levels.

## Diabetic Emergencies

People with diabetes must take responsibility for their day-to-day care. Much of the daily care involves keeping blood glucose levels from going too low or too high. There are two primary emergency medical problems associated with diabetes: **diabetic coma**, which is related to hyperglycemia, and **insulin shock**, which is related to hypoglycemia. Signs and symptoms can occur rapidly (insulin shock), or may occur over a period of several days (diabetic coma).

### Diabetic Coma[85]

A person can become ill if blood glucose levels rise too high (**hyperglycemia**). There is not enough insulin in the body to break down the sugar for use as fuel. When glucose is not available as a fuel source for the body, there is a buildup of **ketones** (acids that are by-products of fat metabolism). The liver increases production of glucose to combat the problem, but the cells cannot use the glucose without insulin, so blood glucose levels become elevated. Without intervention, the hyperglycemia will progress to **diabetic coma** (**diabetic ketoacidosis**, or **DKA**). Sometimes an initial diagnosis of type 1 diabetes is made when the patient is in a diabetic coma.

Early signs and symptoms of hyperglycemia include increased thirst, frequent urination and dry mouth. A diabetic person may recognize the warning signs of hyperglycemia and take appropriate action before the condition progresses. He or she should contact a physician for further instructions or medication adjustment.

Severe hyperglycemia is a medical emergency. **Ketoacidosis** (dangerously high levels of ketones) can result in cell damage, especially in those who have fallen into a coma due to a delay in treatment. The condition can lead to severe illness or death.

**Signs and Symptoms of Diabetic Coma:**

- Dehydration
- Frequent thirst/urination
- Weak, rapid pulse
- Fatigue
- Muscular stiffness or aching
- Nausea, vomiting
- Abdominal pain
- Altered mental status (lethargy, confusion, coma)
- Rapid, deep sighing respirations
- A sweet or fruity odor on breath
- Gradual onset (may be over several days)

**Insulin Shock**[86]

Excessively low blood glucose (**hypoglycemia**) results from taking insulin but not eating enough, or taking too much insulin. It commonly occurs when your body's glucose is used up too quickly, such as when you exercise without increasing food intake, or exercise harder than usual. It may also occur when glucose is released into the bloodstream too slowly (e.g. drinking alcohol).

Early symptoms of hypoglycemia include feeling shaky, nervous, irritable and confused. Judgment can be impaired, so often family, friends and coworkers must recognize the signs and symptoms of hypoglycemia, and know how to treat it. If a person with diabetes has the early signs and symptoms of hypoglycemia, he or she should check the blood glucose (if there is time and access to a meter), and eat or drink something to quickly raise the blood glucose level. There should be an immediate improvement in symptoms.

If blood glucose falls too low, it can result in a loss of consciousness, as the brain needs glucose in order to function. **Severe hypoglycemia is a medical emergency.** It can quickly lead to **insulin shock**, resulting in a loss of consciousness, seizures and even death.

**Signs and Symptoms of Insulin Shock:**

- Altered mental status (confusion, irritability, aggression)
- General discomfort, nervousness or uneasiness
- Pale, cool moist skin
- Dizziness or headache
- Fatigue

- Hunger
- Full, rapid pulse
- Rapid onset
- Tremors or seizures
- Blurry or double vision
- Weakness
- Unresponsiveness

**Treatment for Diabetic Coma and Insulin Shock:**[85,86]

For the first aid provider, treatment is the same:

1. Assess response, breathing, circulation and appearance.
2. Activate EMS system (call 9-1-1).
3. Position of comfort.
4. If person is responsive, give sugar (orange juice, honey, syrup, or a sugar and water solution).
5. If person is drooling, do not give anything by mouth. The person is unable to protect his/her airway.

**Sugar administration is recommended in all diabetic emergencies.** Untreated hypoglycemia will progress to insulin shock, which may cause serious brain damage and respiratory arrest, ultimately leading to cardiac arrest. Administering sugar easily reverses this. On the other hand, there is little risk of worsening the condition of a person in a diabetic coma (severe hyperglycemia).

***Examples of foods or drinks that can quickly raise your blood glucose level:***

- 4 oz. of orange juice
- A regular (not diet) soft drink
- Two teaspoons of sugar dissolved in water
- Hard candy (equal to about 5 Life Savers)
- Honey or syrup
- Glucose tablets (nonprescription sugar pills)
- Glucose gel (nonprescription form of sugar that is rapidly absorbed)

***Avoid Diabetic Emergencies:***

- Obtain medical clearance before beginning an exercise program.
- Discuss with your physician how to manage low or high blood glucose levels during exercise.
- Learn your individual blood glucose response to exercise. Check your blood glucose before and after exercise, and be consistent in the amount and intensity of exercise.
- Drink water before, during and after physical activity.
- Always carry a ready source of fast-acting carbohydrates in case of low blood glucose.
- Wear a medical identification bracelet or necklace.
- Keep a record of each blood sugar measurement to help spot patterns and potential problems. Plan ahead for factors that can affect your blood sugar.
- Be consistent each day in the time and amount of food you eat. Do not skip meals.

- Remember that light physical activities such as gardening, housework, or standing for prolonged periods can affect your blood glucose.
- Physical or emotional stress can cause your body to produce hormones that prevent insulin from working properly, resulting in an increase in your blood glucose level.
- Physical stress includes illness (e.g. a cold, flu, infection, or heart attack) or injury (trauma, surgery).
- Emotional stress may cause you to neglect your regular daily routine.
- Drink alcohol only moderately and always with food; choose drinks that are lower in carbohydrates. Alcohol disrupts the liver's normal production of sugar. After drinking, your liver is occupied metabolizing the alcohol and does not release its stored sugar when your blood glucose level begins to drop. If you have diabetes-related complications, avoid alcohol completely.
- Do not ignore early signs and symptoms of hyperglycemia or hypoglycemia. Educate family, friends and coworkers about the signs and symptoms.

# Eye Emergencies

## Overview[87,88,89]

Almost one million Americans have permanently lost some degree of sight due to an eye injury. There are approximately one million new eye injuries each year. About 43% of them occur in the home. The leading causes include household chemicals, yard and workshop debris, sports accidents, fireworks, battery acid, over-exposure to UV radiation, and inappropriate games and toys with inadequate supervision. There are about 40,000 sports-related eye injuries each year; 90% of them are preventable.

There are about 2,000 work-related eye injuries every day in the U.S. One third of the injuries require treatment in the emergency department. Nearly 90% of all workplace eye injuries are preventable with the use of proper safety eyewear.

The best way to avoid serious eye injury is to take precautions and wear appropriate protective eyewear in the home, garden, workshop, workplace, and during sports activities.

Eye injuries are the most common preventable cause of blindness. If you are unsure about the need for medical attention, err on the side of caution. Do not delay medical care; the injury could worsen and result in permanent vision loss or blindness.

## Penetrating Trauma to the Eye[90,91]

Penetrating trauma to the eye can be upsetting for the rescuer and the victim. Treatment is directed at stabilizing the object, not removing it.

**Treatment:**

1. Monitor response, breathing, and circulation.
2. Calm the person.
3. Send a bystander to activate EMS (call 9-1-1).
4. Control bleeding as necessary.
5. Cover the uninjured eye. The eyes move together, so covering the uninjured eye will also reduce movement of the injured eye. Explain to the person what you are doing.
6. Use a cup, bulky dressing and gauze roll to stabilize the object in place.
    a. Remove the bottom of the cup, cutting a hole for the foreign object.
    b. Secure the foreign body with a sterile dressing.
    c. Place the hollow cup over the eye, being careful not to touch the foreign object.
    d. Secure the cup in place with gauze and tape.
7. Keep all pressure off the eye.
8. **Do not** remove an impaled object from the eye.
9. **Do not** attempt to wash the eye.

## Debris in the Eye[91]

Small, loose foreign bodies in the eye will usually be removed by tears, which are natural flushing agents.

**Treatment:**

1. Instruct the victim to blink several times.
2. Gently flush the area with lukewarm water. Use an eyewash station if one is available.
3. If flushing does not remove the object, use a swab or similar thin, stiff object and lay it across the top of the eyelid.
4. Fold the lid over the swab and flush the eye with lukewarm water, or attempt to remove with wet sterile gauze. Do not try to remove something that is directly over the cornea; the particle might scratch the cornea and cause an infection.
5. If you are unable to remove the source of irritation, seek medical care.
6. **Do not** rub the eye.
7. **Do not** apply ointments or creams.

## Chemical Injury[91]

Chemicals splashed into the eye can lead to injuries causing loss of vision. **It is critical to immediately flush chemicals from the eye.**

Tilt the head down toward the affected eye, and apply a gentle stream of water to the bridge of the nose. The runoff water will then cross the eye and flush out the chemical. Keep the affected eye lower than the unaffected eye to avoid flushing the chemical into the unaffected eye. Flush the eye with copious amounts of water for at least 20 minutes, keeping the eye open as widely as possible. Be sure to remove contact lenses. Ensure that runoff water does not come into contact with other rescuers, but goes directly down the drain or is contained.

Contact your local poison control center for specific instructions. Seek medical care immediately. Take the label or chemical container with you.

## Corneal Abrasions[91]

A corneal abrasion is a scratch on your cornea (the clear, protective single layer of cells over the front surface of the eye). It can be caused by many things, including dust, dirt, sand, a fingernail, tree branch or even a contact lens. When the cornea becomes abraded, it is often described as a continual feeling that something is in the eye. The cornea is very sensitive, so a corneal abrasion is usually very painful. The eye may look red, or you may notice tears, blurred vision, or sensitivity to light. A corneal abrasion must be evaluated by a physician. He or she will often provide antibiotics and an eye patch.

## Blow to the Eye[91]

Gently apply a cold pack to reduce pain and swelling. Do not apply pressure to the eye. If the victim develops a black eye, pain, or changes in vision, see a physician immediately. A black eye may be a minor injury, but it can also be a sign of a significant eye or head injury.

**Tips to Prevent Eye Injury…**

***In the Workplace:***[90,92,93]

- Identify operations and areas that present eye hazards, such as working around a chainsaw or sandblaster.
- Offer vision testing to your employees.
- Provide protective eyewear designed for a specific operation or hazard. (OSHA's eye and face protection standard, 29 CFR 1910.133, requires the use of face and eye protection when workers are exposed to eye or face hazards such as flying objects, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation.)
- Ensure that safety eyewear fits properly and is comfortable.
- Establish a written eye and face protection program, to be administered by a qualified program administrator who is knowledgeable in eye and face protection.
- Provide annual training on protective eyewear and eye safety. Make participation in the safety program mandatory for management and general staff.
- Train employees in first aid procedures for eye injuries, and ensure that they have access to eyewash stations.

***During Sports:***

- Wear protective eyewear (helmet with face protection, sports goggles or face shields) when there is a chance of eye injury.

***At Home:***

- Keep infant's and young children's fingernails cut short.
- Trim low-hanging tree branches.
- Apply contact lenses carefully.
- Pad or cushion sharp edges or corners of furniture and fixtures.
- Use seat belts and child safety seats when driving.
- Avoid toys that fly or fire projectiles, or that have sharp or rigid points or edges.
- Keep chemicals and household products locked up securely.
- Use guards on power equipment.
- Be aware that regular eyeglasses do not always provide adequate protection.
- Wear safety goggles to protect against flying particles, and chemical goggles to protect against exposure to pesticides and fertilizers.

# Head Injuries

## Overview[94,95]

There are an estimated 1.7 million **traumatic brain injuries** (**TBI**) each year. More than 230,000 victims require hospitalization and survive. About 52,000 people die annually from TBIs. Common causes include traffic accidents, falls, accidents at work, home, or during sports activities, or physical assault. Half of all TBIs are caused by motor vehicle accidents.[96]

The skull protects the delicate brain inside. The brain is surrounded by **cerebrospinal fluid** (**CSF**), which cushions it from the light bumps and bounces of everyday activities. The fluid, however, may not be able to absorb the force of a hard blow to the head or a sudden stop. The result can be brain injury from a severe concussion or from tearing of nerve fibers or blood vessels around the brain (**closed head injury**). An external object, such as a bullet or a nail, can also damage the brain (**penetrating head injury**).

Head injuries can be classified as **external**, involving the scalp, or **internal**, involving the skull, blood vessels or brain itself. Skull fractures may be obvious with open wounds, or assumed because of how the injury occurred, or pain in the affected area. A serious brain injury can be life threatening. Providing immediate first aid can save a victim's life.

Assume that any person with a head injury also has a neck injury. When caring for a victim with a suspected head injury, stabilize the head and neck together to prevent further injury. Do not continue the injury assessment. Monitor response, breathing, circulation and appearance. Treat the victim in the position found. All head injuries should be evaluated by a physician.

## External Head Injuries[95]

Most falls or blows to the head result in external injuries. **Scalp lacerations** (small or large wounds to the scalp or face) bleed profusely because the scalp is well supplied with blood vessels. Treat a scalp laceration by controlling bleeding and providing appropriate wound care. The person should be seen by a physician for a large or deep laceration, or if there are any signs or symptoms of brain injury.

A **hematoma**, or "goose egg," is a large swelling on the scalp after a blow. It is caused by the scalp's veins leaking blood into the tissue just beneath the skin. The hematoma may last for several days or even weeks. Apply an ice pack wrapped in a moist cloth to the area for 20 minutes, and observe for any signs of brain injury.

A "**black eye**," or bruising around the eye, is the result of bleeding around the eye and under the skin. Most black eyes are not serious and can be treated by gently

applying an ice pack wrapped in a moist cloth up to 20 minutes. Avoid any pressure on the eye itself. Since bruising around the eyes can be a sign of brain injury or even skull fracture, other symptoms of head injury must be evaluated carefully. If there is bleeding within the eye, it can result in permanent damage to vision. Seek emergency medical care if there is bleeding in the eye or from the nose, vision problems, or other signs of head injury.

Trauma to the **nose** is usually caused by blunt injury. Consider the mechanism of injury and a possible brain or cervical spine injury. Cervical spine immobilization may be necessary. Control bleeding as necessary. Apply an ice pack wrapped in a moist cloth to reduce swelling.

Consider a **facial fracture** if there is irregularity in the contours of the facial bones, pain on palpation, or diplopia (double vision). Seek emergency medical care to determine if the victim has sustained a fracture. Be observant for possible brain or cervical spine injury. Cervical spine immobilization may be necessary. Control bleeding as needed. Apply an ice pack wrapped in a moist cloth to reduce swelling.

With any external head injury, it is important to observe carefully for signs of internal head injury. If the victim shows any changes in mental ability, behavior or physical skills, or has a headache or vomiting, seek emergency medical care immediately.

## Internal Head Injuries[95,96,97,98,99]

Any head injury that causes a period of unconsciousness indicates at least a concussion, and maybe even a more severe injury.

A **concussion** is defined as a bruise to the brain, and may or may not include a temporary loss of consciousness or amnesia of the period surrounding the injury. The person with a concussion will sometimes repeat the same question to the rescuer over and over again. A concussion is caused by a violent jolt (e.g. whiplash, roller coaster) or blow to the head (e.g. a fall with the head striking an object, or a moving object striking the head). A concussion is usually not life threatening, but can have serious effects. The signs and symptoms may appear gradually and can last for weeks. Early symptoms may be overlooked by the victim, family and friends.

There could be bleeding in or around the brain, or swelling of brain tissue. Although a person who has had a concussion will usually make a full recovery, it is important to watch closely for signs and symptoms of further brain injury (see below). A physician should evaluate anyone who has suffered a loss of consciousness or received a significant head injury. The physician may ask you to wake the person during the night to make sure there are no further signs of a brain injury. If the person displays signs or symptoms of brain injury, it is a medical emergency. Activate EMS (call 9-1-1).

A **subdural hematoma** is a collection of blood on the surface of the brain, just below the dura mater (outer covering of the brain). Those at most risk for a subdural hematoma are victims of a head injury, the very young or very old, chronic alcohol abusers, and persons taking anticoagulant medication (blood thinners). Symptoms can take weeks or even months to develop, and may worsen as the hematoma gradually increases pressure on the brain.

About 15% of head trauma victims develop a subdural hematoma. Many subdural hematomas are so small they don't cause any symptoms or need surgical removal. More serious cases may result in permanent brain damage or even death. The person may need a neurosurgeon to perform a **craniotomy** (opening a section of skull to evacuate the hematoma) or drill a **burr hole** through the skull to drain the trapped blood and relieve the pressure on the brain. If someone has symptoms of a brain injury, activate EMS (call 9-1-1).

An **epidural hematoma**, or **extradural hemorrhage**, occurs when there is bleeding between the dura mater and the inner skull. It happens more commonly in young people, because the dura mater is not as firmly attached to the skull. Usually a severe head injury causes a rupture of a blood vessel, which bleeds into the space between the dura mater and the skull. A hematoma (collection of blood) develops, pressing on the brain, increasing the pressure within the skull (intracranial pressure), and causing further injury to the brain.

A **skull fracture** is a crack or break in the skull (the bony covering of the brain). It can affect the brain directly by damaging brain tissue, or indirectly by resulting in the formation of subdural or epidural hematomas, which increase pressure on the brain. Common causes include motor vehicle accidents, falls, physical assault, and sports injuries. Symptoms may be similar to those of other head injuries. Certain symptoms may indicate a basilar skull fracture (fracture at the base of the skull): bloody drainage from the nose or ear immediately after the injury, **raccoon's eyes** (bruises around the eyes), and **Battle's sign** (bruising behind the ears) seen several days after the skull fracture.

**Signs and Symptoms of Head Injury:**[95]

- Head trauma (bleeding, bruising, localized swelling, soft spots or indentations)
- Constant or recurrent headache
- Raccoon's eyes (swelling and bruising under the eyes)
- Bruising behind the ears seen several days after a basilar skull fracture (Battle's sign)
- Confusion, amnesia, repetitive questions, slowed mental processing
- Slurred speech
- Nausea and repeated vomiting
- Difficulty with movement or sensation; loss of balance
- Blurred or double vision; unusual eye movements
- Unequal pupils

- Bleeding from the nose, ears, eyes, mouth
- Seizures
- Loss of consciousness
- Ringing in the ears (tinnitus)
- Abnormal breathing
- Dizziness
- Drowsiness, fatigue
- Neck pain or stiffness
- Loss of bowel or bladder control
- Difficulty swallowing
- Change in sleeping pattern (sleeping much longer or insomnia)
- Change in behavior or mood (irritability, sadness, anxiety, listlessness)

**Treatment:**[95]

1. Assess response, breathing, circulation and appearance.
2. Activate EMS system (call 9-1-1).
3. Immobilize cervical spine (neck) with your hands.
4. Control bleeding (do not apply direct pressure to a suspected skull fracture, as this may increase pressure to the skull).
5. Monitor mental status.
6. Apply an ice pack wrapped in a moist cloth to the bruised area to control swelling. Do not apply pressure.
7. If the person vomits, roll to the side to clear the airway, keeping the head and neck stabilized.
8. Be prepared to report to EMS personnel the mechanism of injury, how long a victim was unresponsive, initial and on-going assessments, person's prior and current mental status, and any past history of head injuries.
9. **Do not** move the victim unless it is absolutely necessary.
10. **Do not** remove a penetrating object.
11. **Do not** leave the person alone.

**Shaken Baby Syndrome**

Shaken baby syndrome is a form of child abuse with severe consequences. When an infant or toddler is shaken, the brain bounces back and forth inside the skull, causing brain bruising, swelling, and possible brain damage or death. The child is usually younger than 2 years old, but it may be seen in children up to 5 years old. Injury can occur with as little as 5 seconds of shaking. 7

***Prevent Falls***[101]

Falls are the leading cause of traumatic brain injury (TBI). People age 75 and older have the highest incidence of injury and death from fall-related TBI. It's important to:

- Reduce the risk for falls.
- Recognize a TBI after a fall.
- Get medical help immediately.

***Tips to Prevent Head Injury:*** [102]

1. Always wear a helmet when:
    - Riding a bike, motorcycle, all-terrain vehicle or snowmobile
    - Playing a contact sport such as football, boxing or ice hockey

- Using roller skates, in-line skates or skateboards
- Skiing or snow boarding
- Batting or running bases in softball or baseball
- Riding a horse

2. Select the right helmet.
   - Make sure helmets fit properly (see manufacturers' guidelines).
   - Consider newer and more advanced helmet designs which may provide better protection.
   - Inspect equipment annually for signs of wear and tear. Follow manufacturers' and state athletic associations' testing guidelines.
   - Bike helmets should be worn directly on the top of the head, covering the top of the forehead. They should not be tipped forward or back. They should be snug, but comfortable. Make sure the chinstrap is attached, and the helmet does not move side-to-side or front-to-back. Most helmets can be customized for fit with the removable pads that are included.
3. Parents and sports coaches should be well educated in the signs and symptoms of a concussion. Coaches must know when to remove players from a game or practice, and parents must be alert to signs of head injury, since many epidural and subdural hematomas are slow to form.
4. Avoid participating in sports activities until cleared by a physician or trained healthcare professional after a previous concussion with unconsciousness. **Studies have indicated that a person who has had a prior concussion has an increased risk of serious brain injury and even death in subsequent brain injuries.**
5. Always wear a seat belt in a motor vehicle, and place infants and small children in appropriate child car seats.
6. Keep firearms unloaded and locked away securely. Firearms are involved in 10% of all TBIs, but 44% of TBI-related deaths.[63]
7. Prevent falls in the home.
   a. Install child safety gates at the top and bottom of stairs.
   b. Install handrails on stairways.
   c. Use non-slip mats in tubs and showers.
   d. Install grab bars next to the toilet and in the tub or shower.
   e. When reaching for high objects, use a step stool, preferably with a grab bar.
   f. Install window guards to protect young children from falling out of windows.
8. Make sure your child's playground surface is made of a shock-absorbent material.
9. Do not dive into water if the depth is unknown.
10. Wear a hard hat when indicated at work.

**For more information:**

Brain Injury Association of America (BIAA)
(800) 444-6443
www.biausa.org

# Heart Attack and Heart Disease

## Introduction

Heart disease is the leading cause of death in the United States. About every minute someone dies of a coronary event in the United States. More than 1.25 million Americans have a first or recurrent heart attack each year. About 70% of the deaths from heart attack occur before the victim reaches the hospital. Heart disease is preventable.[69,3]

The term heart attack can mean many different things to people. Instructors of CPR and First Aid will have to explain to students what a heart attack is, the signs and symptoms of a heart attack, and the appropriate actions to treat the symptoms of a heart attack or other acute coronary syndrome (ACS). It is important to know the difference between a heart attack and cardiac arrest, and understand that a heart attack can lead to cardiac arrest.

## Acute Coronary Syndrome (ACS)

ACS is a term that encompasses many different heart problems that may result in an acute narrowing or blockage of the coronary arteries, leading to death or damage of the heart muscle. It could cause sudden cardiac arrest (SCA). ACS can include acute myocardial infarction (heart attack) and unstable angina.[103]

**Angina pectoris** is chest pain or discomfort due to inadequate blood flow and oxygen delivery to the heart muscle. Angina can be stable, predictable episodes of chest discomfort, often brought on by exertion or stress, and relieved by rest and/or nitroglycerine. It can also be unstable, characterized by unexpected chest discomfort, usually occurring at rest. Stable angina can become unstable, leading to a heart attack.

To reduce confusion among lay providers and for simplification, ACS and unstable angina will be described as a heart attack. ACS or heart attack often results from coronary artery disease (CAD).

## Coronary Artery Disease (CAD)

Coronary artery disease results from a disease process known as atherosclerosis. **Atherosclerosis** is the thickening of the arterial walls from fatty deposits that produce irregularities in the inner lining of the artery. Narrowing of the vessels results in reduced blood flow and the inability of the artery to dilate when the heart requires more oxygen. Atherosclerosis is a form of **arteriosclerosis**, also known as “hardening of the arteries,” which causes a loss of elasticity in the vessel.

CAD creates increased risk for heart attack or other forms of acute coronary syndrome. CAD is a process that begins slowly, through atherosclerosis, relatively early in life. Almost 32% of children 2 – 19 years of age are overweight or obese.

Since being overweight or obese is a significant risk factor for heart disease, this trend will make the fight against heart disease even more difficult in the future. Cardiovascular disease is the underlying cause of death in 1 out of every 3 deaths in the U.S.[69]

CAD can occur faster or slower in people depending on their weight, diet, fitness level, age, sex, and family history, among other factors. The buildup of plaque inside the arterial walls comes from fats and cholesterol contained in many of the foods we eat. Cholesterol is carried by the blood and can attach to the artery walls. Over time the arterial walls narrow, which leads to reduced blood flow.

## Heart Attack[104]

The heart is a muscle that receives nutrients and oxygen through coronary arteries. Because of CAD, a narrowed and hardened artery can easily become obstructed by a fatty mass that has broken off from another vessel and traveled to the coronary artery, or by a blood clot that has formed in the coronary artery (thrombosis).

A heart attack (myocardial infarction, or MI) occurs when a coronary artery is blocked, causing prolonged inadequate blood flow and oxygen delivery to a portion of the heart. The result is death of the heart muscle cells that are normally supplied by the blocked coronary artery.

The severity of a heart attack is determined by the location and extent of the clot, including how much heart tissue is affected. If the area of infarction (cell death from lack of oxygen) is small, the heart may still function adequately. If the MI is large, severe cardiac arrhythmias or SCA may occur.

***Is a heart attack the same thing as cardiac arrest?***

A heart attack and cardiac arrest are not the same thing. A heart attack is the death of heart muscle. Cardiac arrest occurs when the heart stops pumping blood. When a person's heart stops unexpectedly with little or no warning, it is called sudden cardiac arrest, or SCA. A heart attack may lead to cardiac arrest and sudden death, but they are not the same thing.

## Risk Factors Associated with Heart Disease[69]

There are risk factors that contribute to CAD and heart attack. Some risk factors are controllable, while others are beyond our control. We should all be aware of the risk factors and do what we can to prevent or reduce our risk of CAD and heart attack. Combined risk factors significantly increase the incidence of CAD and the likelihood of heart attack.

### Controllable Risk Factors

Reducing the controllable risk factors associated with heart attack is important in order to live a long and healthy life. Consult your doctor before beginning an exercise

program or significant lifestyle changes. Your doctor can identify your risk factors, and then develop a plan to reduce your risk. Consider the following:

**Smoking:** Smoking is the number one preventable cause of serious illness such as heart disease, stroke and lung cancer. It reduces the amount of oxygen in your blood, and increases heart rate and blood pressure.

**Physical Activity/Obesity:** Regular physical activity improves blood pressure and cholesterol levels, helps control weight, reduces the risk of diabetes and reduces stress. Obesity (30 pounds or more overweight) is a significant risk factor for heart attack and stroke. It is caused primarily by eating more calories than are burned through daily activity. The excess calories are stored as fat. Maintain a healthy weight with a varied, healthy diet, more appropriate portions, regular exercise and increased daily activity. Consult your doctor prior to beginning an exercise program.

**Diet:** Foods that are high in saturated fat, trans fat and cholesterol contribute to heart attack and stroke. Healthy foods (a variety of fruits, vegetables, whole grains, low in saturated fat) reduce risk. High salt intake can lead to high blood pressure. Eat a varied, healthy diet with plenty of fruit and vegetables.

**Excessive Alcohol:** Some studies have indicated that one or two drinks a day may increase “good” cholesterol (HDL); however, heavy drinking can lead to high blood pressure, heart disease and stroke.

**High Blood Pressure and High Blood Cholesterol**: Hypertension and high blood cholesterol levels are direct contributors to heart attack and stroke. Keep levels low through regular checkups with your doctor, exercise, a healthy diet and weight, and medication as needed.

A good blood pressure is 120/80 mm Hg. If it’s over 120/80 mm Hg, have it checked more often and report your findings to your doctor. High blood pressure is considered to be 140/90 mm Hg or higher. Sustained high blood pressure (hypertension) is known as the “silent killer,” since it occurs over years without any signs or symptoms. Hypertension causes damage to the blood vessels and increases risk of heart attack and stroke.

High levels of cholesterol are associated with heart disease. Low Density Lipoproteins (LDL) carry cholesterol to the tissues and arteries. High Density Lipoproteins (HDL) carry cholesterol to the liver to remove it from the body. When there is too much LDL circulating in the bloodstream, plaques (cholesterol and other materials) build up on the inside of the artery walls, leading to narrowing of the inside of the artery and hardening of the artery wall. Good levels: <100 mg/dl LDL; >60 mg/dl HDL; <200 mg/dl total cholesterol.

**Diabetes:** Diabetes leads to vascular disease, which automatically increases the risk of heart disease and stroke. Type 2 diabetes can often be prevented with a healthy diet and weight.

**Non-Controllable Risk Factors**

**Age:** The older we get, the more risk of heart disease we have.

**Sex:** Men have higher death rates from CAD than pre-menopausal women. Women have comparable death rates later in life.

**Heredity:** A family history of heart disease is a strong indicator of increased risk. For persons with a family history of heart disease and stroke, it is even more important to identify and control the other risk factors associated with CAD.

**Race:** African Americans are more likely than Caucasians to have high-blood pressure, which can lead to heart disease and stroke.

## Recognition of Heart Attack[105]

When a person suffers a heart attack (or other form of ACS), he or she usually has some common signs and symptoms that should be considered a red flag. Call 9-1-1 right away when you recognize possible signs or symptoms of heart attack.

Signs and symptoms of a heart attack can occur in either sex, and even to young adults at any time or place. Early recognition of the signs and symptoms associated with heart attack or ACS combined with early action (activate EMS) is directly linked to increased survival rates; delays in recognizing signs of heart attack are associated with increased mortality.

Although CAD has a gradual onset, the signs and symptoms from a heart attack or other ACS are usually sudden and intense. In many instances, a victim is not sure what is going on, or is in denial of having a heart attack and waits too long for help. A victim doesn't have to "look bad" to be having a heart attack. If the following signs and symptoms are present, call 9-1-1 (activate EMS):

**Signs and Symptoms of Heart Attack (RED FLAGS)**

- **Chest Discomfort:** Most heart attacks create some form of chest discomfort in the center of the chest that will last for several minutes, or may go away and come back. Chest discomfort is described as pain, pressure, crushing, tightness, squeezing, or fullness (i.e. gas or bloated feeling).
- **Radiating Discomfort:** Discomfort from the chest can radiate or appear in other areas of the upper body. Pain or discomfort can radiate down one or both arms, to the back, neck, jaw, or stomach.
- **Shortness of Breath:** Sometimes shortness of breath occurs before the chest discomfort, or is associated with the onset of chest discomfort. For some victims the shortness of breath is more significant than the chest discomfort.
- **Associated Symptoms:** Pale, cool, sweaty skin; nausea, vomiting; dizziness, fainting.

No one wants to believe that he or she is having a heart attack. Many times heart attack victims **deny their symptoms** or attribute them to another cause. Common

statements include: “It’s indigestion or something I ate.” “It can’t happen to me – I’m too healthy.” “I don’t want to bother my doctor.” “I don’t want to frighten anyone.” “I’ll treat this at home.” “I’ll feel ridiculous if it is not a heart attack.” Don’t be fooled by denial. Delay in calling 9-1-1 costs lives. Most deaths from heart attack occur in the first 4 hours after onset of symptoms.[3]

The warning signs of a heart attack may come in any combination, or all at once. Call 9-1-1 (activate EMS) immediately.

***What if I’m not sure if this is a heart attack?***

Rescuers should err on the side of caution when considering the signs and symptoms of a heart attack. Call 911 if the victim shows any of the signs and symptoms listed above.

**Women, Diabetics and the Elderly**[3,105]

Women, diabetics and the elderly can experience a heart attack without the classic signs and symptoms listed above. Often called a “silent heart attack,” the symptoms of heart attack experienced by seniors, women and diabetics are often more diffuse and can include:

- Cold sweats
- Nausea
- Lightheadedness
- Discomfort between the shoulder blades
- Unexplained weakness and fatigue
- Sense of impending doom
- Neck, back or jaw pain

Emphasize to your students that women are as likely to have a heart attack as men. Healthcare providers are often unaware of this, so symptoms often go untreated, and many heart attacks in women are undiagnosed. Heart disease is undiagnosed in half of the women who have a first heart attack.[106]

**The PQRST Assessment**

When managing a potential heart attack victim, EMS personnel commonly use the PQRST Assessment. It helps rescuers identify and pinpoint the possibility of a heart attack vs. other problems that mimic a heart attack. If there is time, use the PQRST assessment and pass the information on to the professional responders:

**Provoke**: What provoked the onset of chest pain? Activity? What makes the chest discomfort better or worse (e.g. taking a breath makes the pain worse, or nothing makes it better).

**Quality:** Describe the quality of the discomfort. Let the victim use his or her own words. Common descriptions include pressure, squeezing, and fullness (gas or bloating).

**Region/Radiation:** What is the region of discomfort? Does it radiate? If so, where to?
**Severity:** How severe is the pain: mild, moderate or severe? Has it gotten better or worse?
**Time:** How long ago did the discomfort begin?

## Treatment of Heart Attack

If any of the signs and symptoms of a heart attack are present, call 9-1-1. Early recognition and treatment of heart attack can limit damage to the heart. Rescuer actions should be aimed at reassuring and calming the victim to reduce the demand for oxygen, and giving aspirin.

1. Call 9-1-1 (activate EMS).
2. Place the person in a position of comfort; rest and reassure.
    a. The usual position of comfort for someone with signs or symptoms of heart attack is sitting down.
    b. Due to shortness of breath, do not lay the victim down unless he or she becomes unresponsive, dizzy, lightheaded or faint.
3. If the victim is alert and able to swallow, offer aspirin (1 adult or 2 baby) if no allergy, no signs of stroke, and no recent gastrointestinal bleeding.

***Consider what you will do if the victim becomes unresponsive.***

4. If the victim becomes unresponsive:
    a. Lower the victim to the ground.
    b. Send a bystander to call 9-1-1 and get an AED. If you are alone, go call 9-1-1 and retrieve the AED.
    c. Assess breathing. If no breathing or only gasping, begin CPR starting with chest compression. Use an AED as soon as it is available.

Family members of a person at risk for ACS must learn to recognize the signs and symptoms of heart attack and call 9-1-1 instead of a family doctor, or driving the person to the hospital themselves.

### The Use of Aspirin

Victims of heart attack may benefit from taking aspirin in the early stages of a heart attack. Chew the aspirin to help with fast absorption. Take either 1 adult nonenteric-coated aspirin (325 mg) or 2 baby aspirin (81 mg each).

Persons who are at risk for heart attack should check with their physician to make sure aspirin is safe for them (no allergy or contraindications such as recent gastrointestinal bleeding). **Never delay calling 9-1-1 while a person takes aspirin.** Make sure that the victim is alert and able to swallow and it is medically safe before you offer aspirin to the victim of a heart attack.

### Time is Muscle – The use of "Clot-Busters"

Clot-busting medication (fibrinolytic therapy) can be administered to a victim in the early hours of a heart attack. It is most effective if it is provided in the first few hours

after onset of symptoms. It can reduce the effects of a heart attack by reducing or eliminating the clot at the source. It is administered through an intra-venous line (IV) and circulates through the blood stream. Its job is to locate the clot and attempt to dissolve it. Receiving clot-busting medication could make the difference between complete resolution of the heart attack and its symptoms, or lifelong disability or death. Studies have shown a 47% decrease in mortality with the use of fibrinolytic therapy within the first hour after symptoms began.[105]

When discussing the damage a heart attack causes, instructors should indicate, "Time is muscle." As more time passes between the onset of heart attack symptoms and getting to the emergency department, more heart muscle is dying. Save time, save muscle. There is a risk of hemorrhage associated with the use of fibrinolytic therapy.

**The Use of Nitroglycerin**

Some people with a history of heart disease have a prescription for nitroglycerin, a potent vasodilator. It can relieve angina discomfort by dilating the coronary arteries and providing increased blood flow to the heart muscle. Because nitroglycerin lowers the blood pressure, which could cause dizziness and fainting, the person taking nitroglycerin should be in a sitting position. A headache and dizziness are common side effects.

Nitroglycerin comes in a spray or pill form. It is administered under the tongue (not swallowed). It should only be used by the person whose name is on the prescription bottle.

In a person with a known history of heart disease who has been advised to take nitroglycerin before calling 9-1-1, use the following guidelines:

1. Recognize the signs and symptoms of heart attack or ACS.
2. Have the person stop activity and sit down in a position of comfort.
3. Help the person locate and self-administer prescribed nitroglycerin according to physician's orders.
4. Call 9-1-1 if chest discomfort is not relieved within 5 minutes by 1 dose of nitroglycerin.
5. If you are not sure if the person has improved or is out of danger, call 9-1-1

# Heat Emergencies

## Overview[107,111]

Heat-related emergencies are a true medical emergency. They occur most often in the early summer before people have become acclimated to high temperatures. Commonly the temperature is around 100 degrees, the humidity is high, and there is little or no breeze. More than 1,500 people die in the U.S. each year from excessive heat.

Heat-related illness often results from heavy exercise, work, or play in hot weather, accompanied by inadequate fluid intake. These emergencies commonly occur when the salt and water electrolyte balance in the body becomes skewed. Complications also arise when individuals replace water but not salt, or vice versa. The prevention, management and outcome can be determined by pre-hospital intervention.

Most heat-related emergencies happen to people over 65 years of age. Individuals with a diminished response to thirst or impaired ability to sweat are particularly susceptible. Competitive athletes, laborers, alcoholics, unfit or obese people (inadequate cooling mechanism), and soldiers are also extremely susceptible to heat-related emergencies. Other risk factors include aging, dehydration, chronic illness or cardiovascular disease, use of certain medications, and wearing personal protective equipment such as a respirator or protective suit.

**Sweating** is your body's natural cooling mechanism. It is the evaporation of sweat from the skin that produces the cooling effect. The evaporation rate decreases, however, as the humidity level rises. Our bodies also radiate heat through the skin, especially in areas where blood vessels are close to the surface. Since heat always travels to cold, if the outside air temperature is high, our body heat will not effectively travel from the skin to the air (temperature gradient). In environments with extreme heat or high humidity, the cooling system may fail, allowing heat to build up.

When you exercise, wear clothes that are comfortable and allow evaporation of moisture, such as natural fiber (cotton) clothing. Do not overdress in hot weather.

**Dehydration** can be a dangerous heat-related illness. It is normal for the body to lose water daily through urine, sweat, tears, and breathing. When the rate of water loss is excessive, and the fluids and electrolytes are not replenished (hydration), the result is dehydration. Dehydration can also be caused by fluid loss from vomiting or diarrhea.

Children and older persons are especially susceptible to dehydration. Signs and symptoms of dehydration include thirst, dry mouth, less-frequent urination, dizziness, fatigue, confusion, dry skin, and increased heart and respiratory rates. Children may

have few or no tears when crying, fussy behavior, and no wet diapers for several hours.

**Hydration** (consumption of fluids) is critical when working or exercising in hot environments. Consider your body's rate and individual reaction to the fluid loss from sweating and breathing. Drink fluids before and during exercise or activity to maintain hydration. To help you determine how much fluid you lose while working or exercising, weigh yourself before and after the activity. Drink enough fluids to replace at least 80% of that lost. Don't wait until you are thirsty.

Heat emergencies are broken into three categories, which range in severity from mild heat cramps to heat exhaustion to potentially life-threatening heat stroke.

## Heat Cramps[107,108,109]

Painful muscle spasms that generally occur during intense exercise in a hot environment. People are most susceptible when they have not been drinking enough fluids.

**Signs and Symptoms:**

- Hot, flushed skin
- Cramps usually in legs, arms, abdomen or back, but may involve any muscle group involved in the exercise.

**Treatment:**

1. Remove from environment.
2. Rest and cool down.
3. Gently stretch cramping muscles.
4. Massage cramps.
5. Replenish with water or a sports drink.

## Heat Exhaustion[107,108,109]

A condition that can produce signs and symptoms similar to those of shock. It may progress to heat stroke. When people work, exercise or play in a hot, humid environment and lose excessive body fluids through sweating, their body may overheat.

**Signs and Symptoms:**

- Pale, clammy skin (sweating), or hot, red, dry skin
- Elevated temperature, generally less than 104° F
- Elevated heart rate
- Low blood pressure
- Intense thirst
- Fatigue, weakness, faintness
- Anxiety
- Headache
- Cramps

- Nausea

## Heat Stroke[107,108,109]

A potentially life-threatening condition that occurs when the body is unable to regulate its temperature. The body's temperature rises rapidly and the cooling mechanism (sweating) fails. The high body temperature can lead to brain damage or death if not treated promptly.

**Signs and Symptoms:**

- Hot, dry, flushed skin (cessation of sweating). Skin may be moist if heat stroke was caused by exertion.
- Disoriented or unusual behavior; irritability
- Elevated temperature, usually above 104° F
- Increased heart rate
- Rapid, shallow breathing
- Elevated or lowered blood pressure
- Seizures
- Unresponsiveness

**Treatment Heat Exhaustion/ Heat Stroke:**

1. Assess response, breathing, circulation and appearance.
2. Activate EMS (call 9-1-1)
3. Remove person from the environment to a shady or air conditioned location.
4. Loosen or remove clothing. Put modesty aside.
5. Apply cooling measures: fan, cover with a damp sheet, or apply cool water, paying close attention to the head, neck, armpits and groin, where arteries pass close to the surface of the body. Shivering is the body's way of generating heat. If the person begins to shiver during the cooling process, slow down or stop the cooling efforts, dry and cover the person.
6. Monitor body temperature and condition closely. If body temperature increases, especially above 104° F, or if confusion, fainting or seizures develop, person may have progressed from heat exhaustion to heat stroke. Ensure EMS has been activated.
7. Provide cool water or sports drinks if person can tolerate them (no nausea, vomiting, seizure, or confusion). Person must be responsive, coherent and able to hold a glass without assistance.

**Do not** apply rubbing alcohol.
**Do not** give alcohol or caffeine drinks. DO NOT give salt tablets.

Note: Heat stroke can result from leaving a child in a car on a hot day. When the ambient temperature is 93° F, the temperature inside a car can reach 123° F in just 20 minutes.

***Tips to Prevent Heat-related Illness:***[110]

- Know the signs and symptoms of heat-related illness, and how to respond.
- Drink fluids before, during and after activity.

- Increase time spent outdoors gradually to allow time to acclimate to the heat and humidity.
- Perform the heaviest work or activity during the coolest part of the day.
- Protect yourself from the sun with a hat, sunglasses or an umbrella.
- Do not eat large meals before working in hot environments.
- Avoid drinks that make you lose water, such as alcohol or drinks with caffeine.

# Legal Issues

## Introduction

Most students in your basic First Aid and CPR courses will not be healthcare providers and can be classified as lay providers. As lay providers they are not formally medically trained, do not work in the healthcare industry, do not provide direct patient care, and are not considered to have a 'duty to act.' Students in a professional rescuer course may have a duty to act.

Professional responders, licensed healthcare providers or public safety first responders (e.g. paramedics/EMTs, nurses, doctors, police or correctional officers, lifeguards) have a **duty to act**. They have a legal obligation to respond to an emergency while on duty, according to statute or job description. If off duty, they would be responding voluntarily, and would generally be covered under the Good Samaritan Law.

Personnel such as security officers, construction foremen and teachers are usually required to have First Aid and CPR training as part of their job. They are considered lay providers in most cases. If they are designated workplace responders, however, they may have a duty to act, depending on statute and their job description.

## Moral & Ethical Responsibilities

Even if a rescuer does not have a duty to act or a legal obligation to perform CPR (e.g. lay responder, off-duty professional rescuer), he or she should be aware of some moral and ethical responsibilities. It may help to clearly define the terms:
**Moral:** *adj*. concerned with right and wrong and the distinctions between them, virtuous, good, capable of a right or wrong action, serving to teach a right action.
**Ethical:** *adj*. dealing with ethics, relating to morality of behavior, conforming with an accepted standard of good behavior.

What those definitions mean to the students in your certification courses is that even if they are not legally bound to help, they possess the skills to help someone in need of First Aid or CPR. If it is safe to do so, the trained rescuer should assist those in need. Students should be instructed that regardless of age, gender, race, ethnicity or socioeconomic status, they should accept the responsibility to render care to fellow human beings.

Once beginning emergency care, a responder should not abandon the victim. They have a legal obligation to stay with the victim until help arrives.

It is the rescuer's responsibility to update their skills and reinforce their training with continuing education and re-certification courses. They should practice and review

their skills on a regular basis. First aid is only as effective as the person performing it. Know the skills and practice them regularly.

## Good Samaritan Law

Good Samaritan Laws are put into place to encourage the rescuer to act. Every state has a version of a Good Samaritan Law. It is vitally important that you, the instructor, are familiar with how the Good Samaritan Law is written in your state so that you are prepared to answer questions about the law. Keep a copy of your state's Good Samaritan Law with your instructor manual.

If you need help finding your state's Good Samaritan Law, there are many websites available that locate laws and codes by key words. You can also visit your local library or call EMS Safety Services for guidance in locating your state's Good Samaritan Law.

The Good Samaritan Law in most states is designed to protect rescuers from fear of being sued when they choose to act in an emergency. Although anyone can be sued, the Good Samaritan Law provides protection to rescuers as long as they adhere to the stipulations within the law. Common elements of a Good Samaritan Law include, but are not limited to, the following:

- Responding to help or an emergency situation on a voluntary basis.
    - The rescuer does not have a 'duty to act.'
- Not expecting compensation for rendering care.
- Providing care without gross negligence (carelessness, recklessness).
    - Harm did not come to the victim as a result of the rescuer's reckless actions.
- Providing care with good faith (good intentions) and within the limits of your training.
- Not abandoning the victim after beginning care. Stay with the victim until help arrives.

In the instance of CPR, the patient is already clinically dead (cardiac arrest), so it is very difficult to cause harm to that person.

## Gaining Consent[9]

The rescuer must gain consent from the victim before beginning care. Everyone has the legal right to refuse care. To provide care against someone's will can meet the legal definition of assault and battery; transporting someone to a hospital without his or her consent can meet the legal definitions of kidnapping and false imprisonment.

When first approaching a victim, the rescuer should give his or her name, level of training, and intentions, then request permission to begin care. For example, "My name is ____, I've been trained in first aid, and you appear to be bleeding badly. Can I help you?"

**Types of Consent:**

**Expressed**: The victim is a competent adult, informed of procedures and risks. The victim has given consent for care.

**Implied**: Consent is assumed from the victim who is unresponsive or confused. This is based on the assumption that the responsible person would consent to life saving care. This is most often the consent gained in CPR-related situations.

**Children/Minors**: This also applies to mentally incompetent adults. Consent must be obtained from the parent or legal guardian. If the parent/legal guardian is not available for consent in a life-threatening situation, begin care (default to implied consent).[112]

### The Right to Refuse Care[9]

Every mentally competent adult has the right to refuse care. It is not the place of the first aid responder to force care on or make a decision for the victim. Even after you begin care the person can, at any time, refuse further care. An example of this is the person who becomes responsive and refuses further treatment.

Instruct students that they should not force care when it is refused. If they feel a person needs care, they should first ensure their own safety. Keep an eye on the situation from a distance, and contact the Emergency Medical Services (EMS) by calling 9-1-1 or your local emergency response number.

### The Right to Privacy

People have a right to privacy. Information belongs to the person. Keep personal information private. Do not give the victim's information out to bystanders or co-workers. It is acceptable to give information to advanced medical responders who take over care, and to the person in charge of workplace safety.

## Do Not Attempt Resuscitation[113,114]

Most states have state-wide out-of-hospital 'Do Not Attempt Resuscitation' (DNAR) protocols, authorized by statute, regulation, or guidelines. Research your state's laws and protocols on DNAR in the out-of-hospital setting. Learn about your state's Advance Directives (e.g. living wills and medical power of attorney) from your physician or attorney.

These decisions must be made and the advance directives or physician signatures must be discussed and put in place *before* an emergency occurs. "Do Not Resuscitate" orders written for a patient in the hospital are usually specific to that setting. In most states a physician must write a specific 'No CPR' order for out-of-hospital cardiac arrest.

In some states a person with a DNAR order will wear medical jewelry that says “No CPR.” In this situation, do not start CPR; call 9-1-1 and tell the dispatcher that the unresponsive person is wearing jewelry that states, “No CPR.”

# Muscle, Bone and Joint Injuries

## Overview

The human body is made up of more than 600 muscles and 200 bones. Muscles are firmly attached to bones through **tendons**, and provide active movement of the skeleton and maintain its posture. A **joint** is the junction where two or more bones meet, and is supported by **ligaments**, muscles and a fibrous **joint capsule**. Although injuries to a muscles, bones or joints can occur at any age, some types of injuries are more common at certain ages.

There are several types of musculoskeletal injury, including fractures, dislocations, sprains, strains, and contusions. It is not always easy to differentiate between them. Usually the only way to diagnose a fracture with certainty is by x-ray. An exact diagnosis is not important when giving first aid. For the purposes of field treatment, treat fractures, dislocations, severe sprains and strains equally.

## Fractures and Dislocations[115,116,117,118,119]

A **fracture** is a break in a bone produced by excessive strain or force on the bone. It is usually caused by a blow, a fall, a twisting movement, or even no apparent cause (i.e. **spontaneous fracture** occurs without any external injury).

**Types of fracture:**

- An **open fracture** (compound) has bleeding and penetration of the skin by the bone. A suspected fracture with bleeding should be treated as an open fracture, even if the bone is not visible.
- A **closed fracture** (simple) leaves the skin intact.
- A **stress fracture** is a small fracture usually in a weight bearing bone of the lower leg. It is an overuse injury that is caused when muscles fatigue and transfer excess physical stress to a bone.

A **dislocation** is a separation or displacement of bones joined at a joint, with a structural loss of joint stability. It may or may not be accompanied by a fracture (**fracture-dislocation**). It is usually caused by an injury such as a hard blow or fall that could occur during sports activities. Treat a dislocation as a fracture, and seek medical attention immediately.

A **subluxation** (partial dislocation) can occur temporarily, and then the bones may return to their original position. It is important to see a doctor for a subluxation because the joint is now unstable and at risk for re-injury.

**Signs and Symptoms:**

- Swelling
- Bruising
- Deformity, angulation, shortening
- Pain
- Numbness

- Bleeding
- Inability to use the injured part
- Exposed bone ends (open fracture)
- Crepitus (crackling sound with movement)
- A “snap” or “pop” heard at the time of injury

**Treatment:**

1. Keep the person still.
2. Assess response, breathing, circulation and appearance.
3. Activate EMS (call 9-1-1).
4. Observe for signs of hypovolemic shock due to internal bleeding, or a blue or very pale limb. This would indicate a medical emergency.
5. Cover open wounds with a sterile dressing; apply gentle pressure to control bleeding.
6. Apply an ice pack wrapped in a moist cloth. The cold decreases blood flow to the injured area, limiting bleeding into the soft tissue and joint, and reducing the amount of pain, swelling and bruising. Apply the ice pack up to 20 minutes at a time.
7. Only splint the injury if emergency response is delayed or if you decide to transport the victim yourself (e.g. for a finger injury).
8. Monitor circulation and sensation beyond the injury site.
9. **Do not** try to move a victim with a suspected fracture unless it is absolutely necessary.
10. **Do not** try to realign a broken bone or reduce a dislocation yourself. You may damage the joint, muscles, nerves or blood vessels or even fracture a bone.
11. **Do not** give the victim food or fluids. This may delay any necessary surgery.
12. **Do not** walk on an injured leg until evaluated and cleared by an appropriate medical professional.

## Splinting[14]

Splints are applied to suspected fractures, dislocations and severe sprains. The objective is to immobilize the joints above and below the injury. Applying a splint reduces the movement of injured muscles and bones, and allows the person to be transported with less pain and risk of further injury. It also reduces the risk of shock by decreasing internal bleeding. A splint should not cause increased pain.

A splint can be made from a variety of rigid or firm materials, including cardboard, a tree branch, a broom handle, or a tightly rolled blanket or magazine. An injured limb can also be protected by “buddy taping” it to another part of the body.

**Under normal circumstances, in both urban and suburban areas the rescuer should simply immobilize the affected area instead of splinting it. Wait for EMS personnel to arrive and splint the injury.**

**Splinting Procedure:**

1. Explain the procedure.
2. Check sensation and skin temperature before and after splinting.

3. If necessary to control bleeding, expose the fracture site by cutting clothing and removing shoes and socks (except for ankle/foot injuries). If you are splinting an upper extremity injury, remove rings, watches or other jewelry. Swelling may make it difficult to remove jewelry at a later time.
4. Cover open wounds with sterile dressings to control bleeding.
5. Select an appropriate splint that is longer than the bone it will support. Measure the splint against the uninjured limb to estimate the correct size.
6. Pad the splint with soft material to relieve local pressure and ensure even contact.
7. Carefully apply the splint. Do not straighten or manipulate the fracture site; suspected strains, sprains and fractures are splinted in the position found.
8. Use tape or binding to secure the splint in place above and below the injury site (e.g. tape, roll gauze, triangular bandages). It should be snug, but not so tight that it restricts blood flow. Avoid placing bindings directly over the fracture site.

The splinting methods below are for short-term, emergency use. Only apply a splint to immobilize an injury during transport to seek medical care.

**To immobilize a shoulder**, gently bind the arm to the chest, with the strap passing beneath the uninjured arm. High ankle shoes can serve as a splint-in-place.

**Creating a Sling and Swath**

A person with an arm or shoulder injury may need a sling to support and position the limb after the application of a splint. A sling can be created out of almost any long pieces of cloth, such as strips from a shirt or blanket. A swath is used to hold the sling in place against the body and reduce the amount of movement.

Triangular bandages are a great addition to a first aid kit. They can be used as slings, swaths, bandages, or for padding of gaps during the splinting process.

***Create a Sling and Swath***

1. Use a triangular bandage or other large piece of cloth cut or folded into a triangle. For the adult victim the base of the triangle should be 4 to 5 feet long.
2. Place the injured arm into the bandage. The elbow is at the point of the triangle and the wrist should be at its base with the fingers exposed. The sling may need to be sized accordingly.
3. Wrap one end of the sling under the injured arm and the other end over the front of the injured arm and around the neck so that the two ends come together.
4. Tie or pin the ends together so that the arm is bent at a right angle. Ensure the knot is near the back of the neck, to the side (not directly on the spine).
5. Tie or pin the sling at the elbow so that the arm does not slip out of the sling.
6. Create a swath by using an additional triangular bandage or other long cloth. Fold it into a long flat bandage 3 to 4 inches wide. Secure the sling in place by tying the swath over the humerus (upper bone of the arm) and tying the ends under the opposite arm. Ensure the swath is tight enough to restrict the

movement of the shoulder but not tight enough to restrict breathing or cause pain.

## Fractures in Older Adults[120,121,122,123,124,125]

Falls are serious for anyone, but they can have especially serious consequences for older persons. Among Americans over age 65, more than one-third fall each year. In 2009 about 2.2 million were treated in hospital emergency departments for fall-related injuries, and more than 581,000 were hospitalized. More than 18,000 died from fall-related injuries. Approximately 3-5% of older adult falls result in fractures.

**Osteoporosis** is a disease in which there is a gradual loss of bone density, resulting in extremely fragile bones that break under minimal stress. More than 90% of hip fractures are associated with osteoporosis in people older than age 65. Women lose bone density more rapidly than men; 80% of hip fractures occur in older women. A fracture may even occur without an associated fall due to weakening of the bones from osteoporosis (pathological fracture). Half of all women and 25% of men older than 50 will sustain a fracture due to osteoporosis.

Certain medications and chronic medical conditions can result in a weakening of bone. Smoking, excessive alcohol consumption, and nutritional deficiencies can also contribute. Lack of weight bearing activities, such as walking, along with prolonged bed rest, will also result in bone loss.

To prevent falls and the progression of osteoporosis, it is important that older adults, once cleared by their physicians, participate in regular physical activity and exercise that can help improve their strength, flexibility and balance. Other factors that can decrease their risk of falls include a medication evaluation, an eye exam, purchasing proper footwear, and improving home safety (removing throw rugs, placing items within easy reach, not using rolling chairs, etc.).

**Identify common fractures/dislocations in older persons:**

- **Hip fractures**: The leg is often turned outward in an unnatural position, with pain and inability to move the leg. Call 9-1-1.
- **Hip dislocation**: Many older persons have hip replacement surgery. For several weeks after surgery they are at risk for dislocating the new joint if they do not follow specific movement restrictions or if they fall. The leg may be turned inward or outward in an unnatural position, with pain and inability to move the leg. Call 9-1-1.
- **Pelvic fracture**: There may be no visible deformity, but there is extreme pain when attempting to walk, roll, or even move the legs. Call 9-1-1.
- **Compression fracture of the back**: The collapse of one or more individual vertebral bones that may occur with no apparent cause. If the fracture is due to osteoporosis, it is usually stable. It may be very painful, or may have no symptoms at all. Get medical care for evaluation, pain management, and osteoporosis treatment. If unable to move or walk, if pain is severe or caused by injury, call 9-1-1. Do not move the victim.

Fractures can be devastating for an older person. Approximately 20% of people with a hip fracture die within 1 year of their injury. About 25% of adults with hip fracture must stay in a nursing home for at least a year after the injury.

After a fall, many older people develop a fear of falling. This causes them to reduce their activities, which leads to loss of mobility and strength, which actually increases the risk for falls.

## Fractures in Children[116]

Children fall frequently, but the vast majority of children's falls do not result in a fracture. A child's bones are softer than an adult's bones. When a child does sustain a fracture, it may be a **greenstick fracture** (one side of the bone is broken, while the other side bends, such as would occur when trying to break a green tree branch). Fractures in children generally heal faster than fractures in adults.

When a child sustains a fracture of a growth plate (the area of growing bone tissue near the ends of long bones in children and adolescents), he or she may require long-term follow-up to ensure that bone growth has not been interrupted. Approximately 85% of growth plate fractures heal without any long-term complications.

## Sprains, Strains and Contusions[126,127,128,129,130]

A **contusion** is bruising resulting from a direct blow. It is caused when blood vessels are damaged or broken. A **sprain** is a stretching or tearing of ligaments or other structures in a joint, while a **strain** is a stretching or tearing of muscle or tendon (a pulled muscle). A sprain or strain occurs when a structure is stretched beyond its normal range of motion.

When the muscles controlling a joint are weak or "caught off guard" at the moment of injury, a joint can be forced beyond its normal range of motion. Common injury sites include the shoulder, elbow, finger, hip and ankle. Ankle injuries cause the most common joint instability problems. Proper footwear can help support a joint and prevent injury. Strengthening exercises can help prevent recurrent sprains.

Sprains and strains can be classified as mild (only slight stretching or tearing), moderate (partial tear), or severe (complete tear). A mild injury will usually heal within two weeks. An injury with moderate to severe symptoms should be seen by your medical professional. Physical therapy, splinting, casting, or even surgery may be indicated.

If a sprain remains swollen and painful for several days, consult a physician. Signs and symptoms of a sprain or strain are similar to those of a fracture. Closed fractures can often only be detected by x-ray.

***Acute sprains, strains and contusions should be treated with the R.I.C.E. technique:***

**Rest:** Stop activity after an injury. Do not put weight on the injured area.

**Ice:** Apply an ice pack wrapped in a thin moist cloth to the affected area to reduce swelling, bleeding and pain. Apply the ice 20 minutes on, and at least 20 minutes off 3-4 times a day for the first 2-3 days. The cold decreases blood flow to the injured area, limiting bleeding into the soft tissue and reducing the amount of pain, swelling and bruising. An ice pack can be made by placing ice in a plastic bag and covering with a thin, moist towel or cloth. You may also purchase an instant cold pack, but they are usually not as cold as an actual ice pack. Another option is using a bag of frozen peas that will conform around the injured area, and can be refrozen and reused (but not eaten).

**Compress:** Stabilize and support the injured area in the position found. Only apply a splint if the patient must be moved, and if it does not increase pain.

**Elevate:** Raise the injured area above the heart, if it does not increase the pain. This decreases blood flow to the area, reducing swelling and bruising.

***Note:***

- **Do not** apply ice directly onto bare skin, because it can cause frostbite.
- **Do not** apply heat to a new injury, because it will increase swelling and bruising.
- Victims with decreased sensation, diabetes or vascular disease should consult their doctor before applying ice.

***Tips:***

- Avoid injury by warming up before exercise.
- Keep your muscles and joints flexible with regular stretching. A daily stretching program can help prevent injury during physical activity. Although studies have not conclusively shown that stretching immediately prior to activity reduces the risk of injury or improves performance, they have shown that improving overall flexibility does help.

Easy bruising is very common with age due to thinning of the skin and weakening of blood vessels. Often even a minor bump that you don't even notice can result in a large bruise. Prevent bruises by eliminating household clutter and wearing long-sleeved shirts and long pants. Talk to your doctor about medications, supplements or illness that could be contributing to the bruising. Easy bruising could be a sign of a more serious condition, such as a blood disease or blood clotting problem.

Unexplained bruising can be an indication of domestic violence or abuse, especially when the bruising is in an unusual location such as around the eye or face. Ask about the cause of unexplained bruising.

## Whiplash[131]

Whiplash is a common injury that can occur when the soft tissues of the neck are suddenly jerked or 'whipped' beyond their normal range of motion. This can occur when a vehicle is hit from behind or stops suddenly in a crash. It may also occur while playing sports, during a fight, when shaken (shaken baby syndrome), or during roller coaster rides. Pain and stiffness in the neck may develop over the first few days after injury, and may persist for several weeks or even months. Get medical help for evaluation and treatment.

If neck pain is sudden, radiates to shoulders or arms, involves numbness, tingling or weakness of the arms or legs, or any other signs of spinal injury, call 9-1-1. Treat the person in the position found. Stabilize the head and neck together while waiting for EMS responders.

## Muscle Cramps[132]

A muscle cramp occurs when a muscle is locked into an involuntary contraction or spasm lasting from a few seconds to several minutes. Symptoms can range from muscle twitching to severe pain with a hard bulging muscle. The exact cause is unknown, but it can involve muscle fatigue, overexertion, dehydration, exercising in extreme heat, pregnancy, or inadequate stretching. They may also be associated with certain diseases (e.g. circulatory or nerve problem) or medications.

**Treatment:**

1. Stop the activity that triggered the cramp.
2. Gently stretch the muscle until the spasm relaxes and the pain subsides.
3. Apply an ice pack wrapped in a moist cloth to the muscle to relax it.

Prevent muscle cramps with regular stretching, improving your fitness level, and maintaining hydration. If muscle cramps persist, consult your physician to determine a medical cause.

### *Ring Removal*

Removal of a ring may be indicated due to extremity swelling. An application of mild dish soap may help you gently remove the ring. If not, many EMS personnel carry ring cutters in their first aid boxes. Your local hospital emergency department will also have a ring cutter.

# Neck and Spine Injuries

## Overview[133,134,135]

The spinal cord is a group of nerve tracts extending along the back, originating in the brain and ending in the spinal nerves that go to the various parts of the body. It is protected by the vertebral column, a series of bones (vertebrae) that extends from the base of the skull to the tailbone. All the information going from the brain to the limbs (e.g. movement) and from the limbs to the brain (e.g. sensation) travel through the spinal cord.

The spinal cord can be damaged by a contusion (bruising), compression (pressure), or laceration (tearing or severing nerve fibers). When a traumatic event damages the cells within the spinal cord, it can result in loss of movement, sensation, and other activities such as breathing and bladder control. An injury at a specific level of the spinal cord may cause partial or complete loss of motor function (voluntary movement) and sensation below the level of the injury. Although the spinal nerves still exit the spinal cord between each vertebra and go to a particular muscle or organ (e.g. bladder, diaphragm), there is no longer communication (messages being sent or received) with the brain.

An injury to the neck is especially devastating. The neck contains the airway, major blood vessels, and spinal cord tracts which innervate the respiratory muscles and all four limbs. The result of a spinal cord injury at the neck (**cervical spine**) can be **quadriplegia** (paralysis of both arms and legs), inability to breathe without a mechanical ventilator due to paralysis of the diaphragm, and loss of bowel and bladder control. A high enough injury can result in immediate death. A spinal cord injury at the chest level (**thoracic**) or lower back (**lumbar**) can result in **paraplegia** (paralysis of the legs and lower part of the body).

Between 12,000 – 20,000 people suffer spinal cord injuries (SCI) annually in the US; up to 50% will die. Males sustain 80% of SCI. More than half of all victims are 15 to 35 years old. High-risk incidents include motor vehicle accidents (46%), severe blunt trauma and penetration injuries (16%), diving and sports injuries (12%), falls (22%), lightning strikes, head injuries, and any incident in which the victim is unresponsive for an unknown reason. Use of a seat belt and airbag can reduce the risk of injury by 80%. Alcohol is involved in 25% of SCI.

If the victim of a traumatic injury sustains a vertebral fracture, the spinal cord may still be intact. The initial care of a victim with a spinal injury may affect the rest of his or her life. Improper handling of the victim can result in permanent paralysis or even death. If there is a chance of spinal injury, assume there is one. If a victim has a head injury, assume there is also a neck injury.

**Do not move a victim of a severe injury unless:**

1. You need to open or maintain an airway or perform CPR. If the person vomits, carefully log roll him or her to the side, supporting the head, neck and back to prevent twisting.
2. There is imminent danger. Move the victim using a drag or pull; keep the head and spine completely supported and aligned. Improper movement of an injured person can cause severe spinal cord injury.

**Signs and Symptoms:**

- Head, neck or back injury or pain
- Unresponsive trauma victim
- Numbness or tingling in extremities
- Weakness or paralysis in extremities
- Loss of bowel or bladder control
- Difficulty breathing

**Treatment:**

1. Assess response, breathing, circulation and appearance.
2. Activate EMS (Call 9-1-1).
3. Maintain cervical spinal immobilization.
    a. Use the palms of your hands to support the head in the position found.
    b. Maintain an open airway.
4. Reassure the person; keep him or her calm and still.
5. DO NOT move the victim except for airway management, CPR or imminent danger.
    a. Move long axis (drag, pull).
    b. Maintain a neutral position of the neck.

# Poisoning

## Overview

A **poison exposure** is contact with or ingestion of any substance that can produce toxic effects. A **poisoning** occurs when an exposure results in bodily harm. One of the main roles of a rescuer is to recognize that a poisoning may have occurred. Poison exposure can be intentional or unintentional.

A **poison** is defined as any substance (solid, liquid or gas) that causes injury or even death when it enters the body. There are four ways (routes of entry) through which poisons may enter the body:

- Ingestion: swallowing
- Inhalation: breathing dust, gases, fumes or mists
- Absorption: through the skin
- Injection: hypodermic needle, bite or sting

## Statistics[136,137,138]

In 2009, poison control centers received more than 4.2 million calls. Approximately 91% of poisonings occur at home. About half occur in children younger than six years. Almost 2,000 people each day are seen in emergency departments for treatment of poisoning.

The majority of poison exposures were unintentional (84%). Pediatric exposures most frequently involved cosmetics and personal care products, cleaning substances, analgesics (pain relievers), foreign bodies, topical agents and plants.

There is a greater rate of severe outcomes in older victims, and in intentional exposures. Only 2% of the fatalities involved children younger than six years. Analgesics and antidepressants are the drugs most frequently involved in fatal exposures.

### *Prevent poisonings*

Since most poisonings involve children, the best way to address poisonings is to prevent them. It takes only seconds for a poisoning to occur. Children may not be old enough to realize that the things they eat may harm them. Most household cleaners and chemicals are brightly colored. These items can appear like candy or juice to a child.

## Poisons Act Fast – So Must You!

**General Signs and Symptoms:**

- Throat pain; abdominal pain
- Nausea and vomiting
- Drooling or unusual odor on breath

- Altered level of response; behavior changes
- Sweating
- Diarrhea
- Difficulty breathing
- Seizures
- Burns, redness or blisters around the mouth
- Empty bottles or containers; disturbed plants

**General Treatment:**

1. Check for scene safety and clues.
2. Remove victim if necessary.
3. Assess response, breathing, circulation and appearance.
4. Place in a position of comfort.
5. Identify the poison, how much and when it was taken.
6. Contact EMS (call 9-1-1) for a victim who has an altered level of response or is in distress.
7. Contact the poison control center for a conscious victim in no distress.
8. Locate Material Safety Data Sheets (MSDS) for chemical exposure.
9. If the person might vomit, roll him or her into a sidelying position to protect the airway.

**Do not** give the victim food or drink unless instructed to do so.
**Do not** induce vomiting unless instructed to do so by the poison control center or a medical professional.

## Poison Control Centers

While waiting for EMS personnel to arrive, call the poison control center. They can advise you on the preferred treatment and help you keep the person comfortable. If EMS arrival is delayed, the poison control center may direct treatment. If the recommended treatment is vomiting, keep in mind that a poison that burned while going down will also burn while coming back up. **Never induce vomiting unless instructed to do so by a poison control center or medical professional.**

**The poison control center number is (800) 222-1222**. When you call you will be connected to a poison control center in your region. They are available 24/7/365, and all calls are free and confidential.

## Swallowed Poisons

Commonly ingested poisons include household cleaning products, plants, chemicals, cosmetics, an overdose of medication, and illegal drugs. Collect any empty/spilled containers, bottles or unknown plants to send with the person to the hospital. Make a record of the victim's age and weight, any medications he or she may be taking, the time of the poisoning, and the amount you think was swallowed.

Since most poisonings involve children, it's important to child proof your home:[141]

- Lock dangerous items out of sight and reach (e.g. medicines, household products and personal care products).
- Keep products in their original containers.
- Buy household products and medicines in child-resistant packages.
- Return products to safe storage immediately after use.
- Never call medicine “candy” or take it in front of children.
- Check your home for lead-based paint. (For more information, contact the National Lead Information Center at (800) 424-LEAD.)
- Know the names of the plants in your house and yard. Remove poisonous plants.
- Keep important phone numbers by every phone (e.g. EMS, Poison Control Center, police and fire departments, your physician).
- Some communities supply brightly colored stickers that may warn children away from hazardous substances. Contact your local poison control center to find out more about child proofing your house.

## Inhaled Poisons

Inhalation hazards include pesticides, fumigants, smoke from fires, as well as chemical fumes, vapors and gases. Carbon monoxide and carbon dioxide are particularly hazardous, as they are colorless and odorless. In the home fumes may come from cleaners and solvents, wood, kerosene or coal stoves that are not working properly, leaky gas vents, or a car running in a closed garage.

Signs and symptoms vary with each type of exposure. Some cause eye irritation while others cause irritation of the respiratory tract. Additional symptoms may include pale or bluish skin color, chest pain or tightness, dizziness, headache, confusion, irritability, nausea or vomiting. Get the victim into fresh air right away. If the victim is breathing without difficulty, call the poison control center. If the victim is having trouble breathing or has other signs or symptoms or poisoning, contact EMS (call 9-1-1).

***To prevent inhaled poisoning:***

- Open windows and turn on a fan when using chemical products.
- Make sure combustion appliances (fuel burning) are professionally installed and inspected annually.
- Do not mix chemicals or household products. For example, mixing bleach and ammonia together creates chloramines, a poisonous gas.
- Do not burn charcoal or use gasoline-powered engines in confined spaces such as tents, garages or poorly ventilated rooms.
- Place carbon monoxide and smoke detectors near the bedrooms in your home.

### Confined Space Emergencies

Confined spaces may contain an accumulation of flammable or toxic gases, many colorless and odorless. Hundreds of employees die each year in confined space accidents. Rescuers can become victims themselves because they need to get close to the victim in order to pull him or her out.

Follow OSHA prescribed permit entry. Avoid becoming a victim; do not enter any confined space without proper equipment and training.

## Absorbed Poisons[142]

Many substances can enter the body through the skin. The three most common types of absorbed poisons are poison ivy, poison sumac, and poison oak. Recognizing these plants is difficult for most people. The severity of the symptoms will depend on the extent of the exposure and the victim's sensitivity to the plant.

Exposure to any of these substances can cause itching, swelling, redness, burning, blisters, difficulty breathing, fever, headache, and generalized weakness. Remove exposed clothing carefully and wash skin thoroughly with soap and water ASAP. Rinse the exposed area with rubbing alcohol to avoid spreading the oil. Contact a physician for treatment.

### Chemical Spill

If a chemical is spilled on the skin, use gloves to remove exposed clothing, then rinse the skin with warm water for at least 20 minutes. Take care to avoid spreading the contamination. Contact the Poison Control Center for further advice. Review the Material Safety Data Sheet (MSDS).

### Poison Oak[142]

Poison oak is probably the West's most common outdoor plant hazard. Recognizing it can be difficult because the plant can take a number of forms: free standing shrub, vine, or ground cover. "Leaves of three, let it be." The leaves that generally grow in clusters of three are thin, shiny, and oak-shaped. Green in spring and early summer, the leaves turn deep red toward fall, then drop off entirely revealing grayish branches decorated with white berries.

The leaves, stems, and berries all contain a chemical compound call urushiol. Just brushing against poison oak can get this oil on your skin. Within minutes the urushiol will have entered the dermis (inner) layer of skin. A red rash will usually appear 12-48 hours later. The same oil is found in poison ivy and poison sumac.

Most people have no reaction the first time they are exposed. Up to 30% of people never develop sensitivity to the oil. Children under age seven are rarely sensitive. It's best to avoid any contact with poisonous plants. Be aware that the oil is spread easily and can stick to almost anything, even when dry.

## Injected Poisons

The bites and stings of various insects, snakes and marine animals can inject venom into a victim. Although the bites and stings are generally not life-threatening, they can cause an allergic reaction, which can develop into anaphylactic shock.

Medications and illegal drugs can also be injected with a hypodermic needle.

**Substance Abuse**[139,143]

Drug and alcohol emergencies are becoming increasingly common in today's society. Almost 75% of all adult users of illegal drugs are employed.

It is often impossible to determine the cause of a patient's problem. Be observant for syringes or drug paraphernalia, needle marks, the smell of alcohol on the victim's breath, empty pill or alcohol containers, and an altered level of response (e.g. confusion, panic, agitation, threatening behavior).

It is not uncommon to encounter victims of drug overdose, alcohol poisoning or alcohol withdrawal in respiratory arrest or with seizure activity. Follow general treatment guidelines for poisoning, beginning with assessing response, breathing, circulation and appearance. If it is likely that the person will vomit, turn him or her to the side. If the person has an altered level of response, activate EMS. Give any drugs or medications found on scene to the EMS responders.

Rescuers must always concern themselves with the increased potential for violence, as these patients are often uncooperative and combative. Calm an agitated or threatening person. Ensure an escape route if the person becomes violent.

**Alcohol Abuse**

Over 30 million people in the U.S. age 12 or older reported driving under the influence of alcohol in 2009.

**Lead Poisoning**[144]

Lead poisoning is of great concern to health officials, since it affects nearly every system in the body. It may have no obvious symptoms, or it may result in slowed growth, damage to the brain and nervous system, behavioral and learning problems, and impaired hearing. More severe cases can result in seizures, coma and death.

In the U.S., approximately 250,000 children between the ages of one and five have blood lead levels greater than the CDC recommended level. Those at highest risk for lead poisoning are children under the age of six, children in low-income families, and persons living in housing built prior to 1978 (when lead-based paints were banned for use in housing).

Children are exposed to lead primarily through lead-based paint and lead-contaminated dust found in older buildings. Other sources of lead poisoning are from certain hobbies (stained-glass), work, drinking water (lead pipes, brass fixtures), and home health remedies. Lead poisoning can be prevented by keeping children from coming into contact with lead, and treating those who have.

**Foodborne Illness**[145,146]

There are 76 million cases of foodborne illness annually in the United States. The primary causes of foodborne illness are bacteria (e.g. Salmonella, Listeria, E. coli, Clostridium botulinum), viruses (e.g. hepatitis A) and parasites (e.g. Giardia lamblia). They can be found in a wide range of foods. Practice these four steps to food safety:

1. **CLEAN**: Wash hands and surfaces often.
    - Wash your hands, cutting boards, dishes, utensils, and counter tops with hot, soapy water before, during and after preparing food.

2. **SEPARATE**: Don't cross-contaminate.
    - Always keep raw meat, poultry, seafood and their juices away from other foods.

3. **COOK**: Cook to proper temperatures.
    - Use a food thermometer to make sure foods are cooked to a safe internal temperature.

4. **CHILL**: Refrigerate promptly.
    - Be sure to refrigerate foods within two hours. Set your refrigerator no higher than 40° F and the freezer at 0° F.

# Positioning and Moving a Victim

## Introduction

During most emergency situations you should not move the victim. EMS responders will assess and stabilize for transport. Only move a victim to provide essential care, to reach another person who is seriously injured, or if there is immediate danger:[1]

**Types of Immediate Danger:**

- Fire or smoke
- Explosives, danger of explosion, or other hazardous materials
- Traffic
- Structural collapse, unstable surface
- Downed electrical wires
- Any other environmental danger

## Victim Positioning

### Recovery Position[3,23,147]

When victims are placed in the recovery position, they are placed on their side using the log roll technique to minimize spinal movement. The airway of a person who is unresponsive and in a supine position (on the back) can be easily blocked by the following:

- The tongue falling back and covering the trachea (windpipe)
- Vomit, mucus and other secretions pooling in the throat

By placing the victim on his or her side, the tongue falls forward and fluids are allowed to drain. Use the recovery position for a victim who is unresponsive and breathing normally when:

- Fluids, blood or vomit may block the airway
- A rescuer must leave to summon help
- Any victim is unresponsive and the rescuer cannot manage the airway

Consider these principles when utilizing the recovery position:

1. The victim should be in a true sidelying position as much as possible, not too far prone (face down) or too far supine (face up). The head should be slightly down to allow fluids to drain, and the lower arm in front of the body.
2. The position should be stable, and may vary between victims.
3. Avoid any pressure on the chest that impairs breathing.
4. It should be possible to turn the victim onto his or her side and to return to the back easily and safely, with consideration for a possible spine injury.
5. Good observation of and access to the airway should be possible.
6. The position itself should not harm the victim.

To place a victim in the recovery position, use the **log roll** to avoid further injury. One rescuer can use the log roll, but it is easier with two. Only move a potential trauma victim if you cannot otherwise keep the airway open (leave to get help).

Use the **modified H.A.IN.E.S. recovery position** (High Arm IN Endangered Spine) when an **unresponsive person is breathing normally** and you must leave to get help, or when fluids or vomit may block the airway. This is the best recovery position if a neck or back injury is suspected because it significantly reduces the amount of lateral flexion of the head and neck. In the modified H.A.IN.E.S. position, the head is supported by the victim's arm.

1. Grasp the arm furthest from you and gently lift it above the person's head. Place the arm nearest you by the person's side. Bend the knee furthest from you.
2. With one hand, stabilize the base of the skull and place your forearm under the shoulder. Place your other hand under the hip and arm nearest you.
3. Carefully roll the person away from you. **Do not** push the head or neck. Bend the top knee so both knees are flexed to stabilize the victim.
4. If you must leave to get help, place the person's hand, palm down, under the head near the armpit.

If the victim remains in the recovery position longer than 30 minutes, turn the victim to the opposite side to avoid blood vessel and nerve injury.

A victim who is obviously pregnant should be placed on her left side to avoid complications caused by the weight of the baby pressing down on vital blood vessels.

**Positioning a Responsive Victim**

- **Shock Position**: Position a person lying down, face up if he or she has signs of shock, or feels dizzy or faint.
- **Sitting up**: A person who is having difficulty breathing can usually breathe easier in this position. If a person can't get out of bed, prop him or her up with pillows or blankets. A person with severe shortness of breath may sit upright in a rigid position, supported on his arms (tripod).
- **Position of Comfort**: Help a person into the position that is most comfortable. A person can often find the position that reduces pain, nausea, or shortness of breath.

## Lifting and Moving Principles

Remember the following principles of lifting:

- Know your capabilities; ask for help with a heavy or awkward load.
- Use as much of your palms as possible for a safe lift.
- Keep your back straight, tighten your abdominals, and bend your knees.
- Lift with the strong muscles of the thigh and buttocks, not with your back.
- Position your feet shoulder width apart for balance, with one foot slightly in front of the other.
- Lift with the victim close to your body.
- Do not twist your back; pivot with your feet.

- Lift and carry slowly, in unison with others.
- Before you move a victim, let him or her know what you're going to do.

## Emergency Moves[14]

If an emergency move is required due to immediate danger, consider:

- Moving the victim (especially quickly) can worsen a spinal injury.
- Pulling the victim in the direction of the long axis of the body to protect the spine as much as possible.
- Never pull the victim's head separate from the neck and shoulders.

### Drags and Carries

**Drags and carries generally do not provide cervical spine stabilization.** Use only when rescuer and victim are in immediate danger and an emergency move is required.

**Ankle Drag**: Grab the victim by the ankles and drag to safety.

**Blanket Drag**: Place the victim on a blanket using the log roll technique and drag to safety.

This can also be performed as a **clothes drag** by pulling the victim's clothing in the neck and shoulder area, and supporting the victim's head and neck with your forearms.

**Armpit-Forearm Drag:** Kneel down behind the victim's head and neck. Reach under the armpits and interlace your fingers. Support the head and neck, stand with your knees and drag the victim to safety. This technique is good for short distances over a rough surface.

**Shoulder Pull:** Grasp the victim under the armpits, support the head on your forearms and drag.

**Clothes Drag**: Grasp the neck and shoulders of the shirt or jacket, support the head with your forearms and drag. Make sure the clothing does not press on the airway.

**Human Crutch:** Help the victim to walk by supporting the injured leg and helping him or her walk on the good one. Do not walk the victim if he or she becomes lightheaded or sweaty when standing, has chest pain or difficulty breathing, has a suspected spinal injury, or a seriously injured leg. [14]

**Firefighter's Carry:** If the victim's injuries permit, place him or her over your shoulder. This carry is good for lone rescuers who have to travel long distances.

**Pack Strap Carry:** Similar to the firefighter's carry, but reserved for victims whose injuries will not permit the use of the firefighter's carry. Place the victim on your back

with an arm over each shoulder. Secure your hold by crossing the person's arms and grasping the wrists.

**Seat Carry:** (requires two rescuers) Grasp hands or use a four-handed technique by inter-linking the rescuers' forearms and creating a 'seat' for the victim. The victim should hold on to the rescuers' shoulders. This is the easiest two-person carry when no other equipment is available.

**Cradle Carry:** Cradle the victim in your arms. Use for children or small adults.

## Non-Emergency Moves[14]

Non-emergency moves are used to transfer a patient to a stretcher or board. There is no immediate danger, so there is time to select the right equipment. Use these moves when spinal or head injury is not suspected. It is helpful to practice before using these techniques.

**Direct Ground Lift:** No suspected spinal injury

1. Line two or three rescuers up on one side of the person.
2. Kneel on one knee, preferably the same knee for all rescuers.
3. Place the person's arms on his or her chest, if possible.
4. 1st Rescuer is at the head in charge of calling signals:
    a. Place one arm under the neck and shoulder and cradle the head.
    b. Place the other arm under the lower back.
5. 2nd rescuer:
    a. Place one arm under the person's knees.
    b. Place the other arm above the patient's buttocks.
6. If a 3rd rescuer is available:
    a. Place both arms under the waist.
    b. Other two rescuers slide arms up to the mid-back or down to the buttocks as appropriate.
7. On signal, lift the person to their knees and roll in toward their chests.
8. On signal, stand and move the person to the stretcher.
9. To lower the person, reverse the steps.

**Extremity Lift:** No suspected extremity injury

1. 1st rescuer kneels at the person's head.
2. 2nd rescuer kneels at the side of the person by the knees.
3. 1st rescuer places one hand under each of the person's shoulders, slips his/her hands under the arms and grasps the person's wrists.
4. 2nd rescuer slips her/her hands under the patient's knees.
5. Both rescuers move up to a crouching position.
6. On signal, the rescuers stand up and move with the patient to a stretcher.

**Transfer a Supine Patient from a Bed to a Stretcher: Direct Carry**

1. Prepare stretcher: adjust height, lower rails, unbuckle straps.
2. Position stretcher perpendicular to bed with head end at the foot of the bed.
3. Rescuers stand between the bed and stretcher, facing the patient.
4. 1st rescuer slides arm under patient's neck and cups patient's shoulder.

5. 2nd rescuer slides hand under hip and lifts slightly.
6. 1st rescuer slides other arm under patient's back.
7. 2nd rescuer places other arm under patient's calves.
8. Slide patient to edge of the bed and lift toward the rescuers' chests.
9. Rescuers rotate, and place the patient gently onto stretcher.

**Transfer a Supine Patient from a Bed to a Stretcher: Draw Sheet**

1. Loosen bottom sheet of bed.
2. Prepare stretcher: adjust height, lower rails, unbuckle straps.
3. Position stretcher next to bed.
4. Rescuers stand next to each other, with stretcher between them and the bed.
5. Reach across stretcher & grasp sheet firmly at patient's head, chest, hips, knees.
6. Slide patient gently onto stretcher.

## Equipment for Moving Patients[14]

Although most first responders are not equipped with devices for moving patients, it is helpful to be familiar with the equipment EMS responders may bring to the scene. First responders who assist their local EMS agency should practice with them to become familiar with the types and operation of the following:

**Wheeled Ambulance Stretcher (cot or gurney):**

- Can be raised or lowered, head can raise, sometimes foot can raise
- Can be rolled by two or four people with rescuers at the head and foot ends
- Can be carried by two or four people:
    - Best with four rescuers, one at each corner
    - With two rescuers, face each other from the head and foot of the stretcher

**Portable Stretcher:**

- Use when a wheeled stretcher cannot be moved into a small area
- Carry in the same way as a wheeled stretcher

**Long Backboard:**

- Use for trauma patients to protect neck and spine
- Use for lifting patients from small spaces or up onto a stretcher
- Immobilize head and neck; secure patient with straps before moving
- Can be used as CPR surface

**Short Backboard:**

- Use to immobilize the head, neck and spine of a patient found in a seated position (e.g. automobile or confined space)
- Some are simple boards with straps; others wrap around the patient and secure the head, neck and torso. (Kendrick Extrication Device, or KED)
- Once extricated, patients stay attached to the short backboard and are then secured to a long backboard.

**Stair Chair:**

- Use to carry a patient in a seated position

- Good for small spaces, stairs, and patients with difficulty breathing
- Can be tilted back and rolled or carried
- To carry, rescuers face each other, similar to a stretcher
- Not used for suspected trauma patients

**Scoop Stretcher:**

- A rigid device that separates into right and left halves
- Rescuers scoop each half under the patient and reconnect the ends.
- Helpful for moving patients out of small or tight spaces
- Straps can be attached
- Not used for suspected trauma patients

# Respiratory Emergencies

## Overview[148]

Acute (sudden) shortness of breath (SOB), a symptom of respiratory distress, is a medical emergency. There can be many causes, including heart attack, asthma, collapsed lung, pulmonary embolism, congestive heart failure, allergic reaction, choking, emphysema, bronchitis, and respiratory illness. Electrocution, poisoning, or an injury to the head or trunk can also cause respiratory distress. Generally, the treatment for respiratory emergencies is the same. Fast recognition of the emergency together with prompt activation of EMS (9-1-1) is critical. Delay can be fatal.

**Signs and Symptoms:**

- **Breathing rate:** Too fast or too slow; agonal breathing (gasping, irregular, or only a few breaths per minute)
- **Noisy breathing:** Wheezing, gurgling, high-pitched whistle-like sound
- **Sitting upright:** Tripod positioning, upright, leaning forward, chin lifted, mouth open
- **Labored breathing:** Using shoulder and back muscles to assist breathing
- **Broken dialogue:** Speaking in short sentences or one word answers, pausing for breath
- **Color:** Ashen, pale, cyanotic (blue skin, especially around the lips and fingernail beds)
- **Cough, fever**
- **Dizziness, confusion**
- **Chest pain:** Caused by injury, heart attack, collapsed lung or pulmonary embolism
- **Children:** Nasal flaring, rib retraction (pulling inward of the ribs with breathing)

**Treatment:**

1. Assess response, breathing, circulation and appearance.
2. Activate EMS (call 9-1-1).
3. Position of comfort, usually sitting up.
4. Loosen tight clothing.
5. Monitor status closely until EMS responders arrive.

**Medical Illnesses resulting in Respiratory Distress**

- **Heart Attack** (see separate section)
- **Asthma** (see below)
- **Allergic reaction** (see separate section)
- **Choking** (see separate section)
- **Congestive heart failure** (CHF): A condition in which the heart gradually fails in its ability to deliver blood to the tissues of the body. The result is a buildup of fluid in the legs, ankles and feet, and a backup of fluid into the lungs, leading to SOB. CHF can be caused by heart attack or heart disease.[149]
- **Chronic obstructive pulmonary disease (COPD**): A group of lung diseases, including chronic bronchitis and emphysema, which limit the flow of air into

and out of the lungs. Approximately 80% of all cases are caused by heavy, long-term cigarette smoking. Other causes include repeated infections, such as pneumonia, and inhalation of toxic agents, such as industrial gases. The main signs and symptoms are SOB, chronic cough, fatigue, weight loss, and excess mucus production (bronchitis). Although COPD cannot be cured, it can be treated. A patient may use an inhaler or supplemental oxygen to help breathe better. People who quit smoking will also stop, or at least slow, the progression of emphysema. Exercise (with medical clearance), proper diet, adequate rest, and stress management will also help prevent exacerbation of COPD.[150]

## Respiratory Illnesses

**Croup** is usually seen in children ages 3 months to 3 years, with age 21 months being the most common. Croup is caused by viral agents and is characterized by a barking cough, stridor (a high-pitched sound during obstructed breathing), wheezing, mild retractions and fever.

**Signs and Symptoms:**

- Difficulty breathing
- Inability to swallow
- Tripod position
- Hoarseness
- Retractions (pulling inward of the ribcage)
- Barking cough
- Fever

**Treatment:**

1. Assess response, breathing, circulation and appearance.
2. High humidity therapy (Fill bathtub or sink with hot, steamy, water.)
3. Use humidifier if available.
4. Give ibuprofen and use cooling measures for fever. If fever should spike greater than 102° F, notify a physician.

**Respiratory Syncytial Virus** (RSV) is a common virus that causes cold-like symptoms in adults and older children, but can be more serious in babies. It is more prevalent in the infant/toddler age group. It commonly occurs in the fall/winter months.[151]

**Signs and Symptoms:**

- Low-grade fever
- Slight cough
- Profuse, thick, clear nasal secretions
- Watery eyes
- Labored, rapid breathing; shortness of breath

**Treatment:**

1. Bed rest

2. Encourage fluids (to thin the secretions and prevent dehydration).
3. Suction nose with bulb syringe to clear nasal passageway.

**Pneumonia** is a respiratory condition that affects millions of people of all ages in the U.S. each year. It can be especially serious for older adults or those with chronic illnesses. Pneumonia can be caused by various agents (e.g. bacterial infections, viral infections, aspiration). The infection can destroy lung tissue and cause fluid build-up in the surrounding normal lung tissue. Pneumonia reduces the lungs' ability to exchange oxygen for carbon dioxide, lowering the blood oxygen level. The person may breathe faster to compensate. Over 52,000 Americans die each year of pneumonia. If you suspect that you have pneumonia, see your doctor promptly. It can be positively diagnosed with a chest x-ray. Pneumonia can be prevented with vaccines.[152,153]

**Signs and Symptoms:**

- Fever
- Fatigue
- Rapid, shallow respirations, shortness of breath
- Cough, runny nose
- Chest pain
- Sweaty, clammy skin; chills

**Treatment:**

1. Get medical care for proper antibiotic therapy.
2. Bed rest
3. Encourage fluids.
4. Give ibuprofen and use cooling measures for fever. If fever should spike greater than 102° F, notify a physician.

**Pertussis**, also known as **whooping cough**, is caused by a bacterial source known as Bordetella Pertussis. Pertussis has an incubation period of 5-21 days. This childhood disease is transmitted by droplet spread of infected persons, direct contact, or also indirectly when one comes in contact with freshly contaminated objects. The greatest risk of infection is during the initial stage of pertussis, before the onset of its characteristic "sudden attacks" of coughing.[154]

**Signs and Symptoms:**

- Initial Prodromal stage: fever (fever may spike as high as 104°F between day 4 and 5. Notify physician of any fever greater than 102°F).
- Malaise
- 24 hours of runny nose, cough, and conjunctivitis.

After 1-2 weeks, symptoms worsen.

- Prolonged coughing attacks
    - Coughing may end with a high-pitched "whoop" sound when you inhale the next breath.
    - Persistent, hacking cough

**Treatment:**

1. Bed rest during the febrile period. Ibuprofen for fever; avoid chilling.
2. Keep skin clean and dry. Use tepid bath.
3. Use cool mist vaporizer for cough.
4. Encourage fluids and soft, bland foods.
5. Clean eyelids with warm saline solution to remove secretions and crust.

If you suspect that someone is having a respiratory emergency, call 9-1-1 without delay.

## Asthma[155,156,157]

Asthma is a chronic disease in which the main air passages of the lungs become inflamed. During an asthma attack, the muscles around the airways tighten and extra mucus is produced, progressively blocking the airway. This results in narrowing of the bronchial airways and less airflow to the lungs.

Approximately 25 million Americans suffer from asthma; 9 million of them are children. More than half the people with asthma have an asthma attack each year in the United States. Thousands of people die each year from asthma. It affects a higher percentage of low income, minority, and inner-city populations, and can develop at any age.

The incidence of asthma has increased significantly in the past 20 years. It is now the most common chronic childhood illness. The exact cause is still unknown, but possible factors that can increase your risk include air quality (pollution, secondhand smoke or occupational chemicals), building ventilation, health issues such as obesity and lack of physical exercise, respiratory infections in childhood, low birth weight, having at least one parent with asthma, and gastroesophageal reflux disease (GERD).

Although there is no cure for asthma, it is treatable. Medical treatment includes quick-relief or “rescue” medicines to relieve asthma symptoms that flare up, and long-term control medicines. It’s also important to avoid things that could worsen your asthma symptoms.

**Triggers that can cause or worsen an asthma attack include the following:**

- Strong odors (perfumes, cooking fumes, chemicals)
- Exercise or physical exertion
- Respiratory infection (e.g. the common cold) and sinusitis
- Change in the weather (temperature, humidity, wind, barometric pressure)
- Inhaled substances (talcum powder, chalk dust)
- Emotional stress and anxiety
- Allergens (e.g. pollen, pet dander, dust mites, cockroach droppings, mold)
- Irritants (e.g. dust, tobacco or wood smoke, air pollution)
- Sulfites (food preservatives)

- Medication allergies
- Occupational exposure to chemical fumes, gases or dust

Asthma attacks can be controlled by taking medicine and avoiding the triggers that cause an attack. Many asthmatics carry inhaled bronchodilators that open narrowed air passages and ease breathing.

An episode can occur with little warning. It's important to recognize the symptoms and respond quickly. By treating attacks early, the severity of the attack is usually lessened. Early activation of 9-1-1 saves lives!

**Signs and Symptoms:**

- Labored, rapid breathing
- Coughing (sudden, non-productive "tight" cough initially; progresses to rattling and productive, with clear, frothy sputum)
- Audible wheezing
- Shortness of breath (speak in short, panting phrases)
- Chest tightness
- Anxiety, apprehension, restlessness
- Upright, rigid posture with arms locked and supporting body weight (tripod position)
- Cyanosis
- Flared nostrils
- Sweating
- History of asthma attacks (May have a medically prescribed asthma inhaler.)

**Treatment:**

1. Assess response, breathing, circulation and appearance.
2. Help person locate the inhaler and self-administer it, if patient indicates that he or she is having an asthma attack and needs help.
3. Determine the attack trigger.
4. Call 9-1-1 if no relief from the inhaler.
5. Position of comfort, usually sitting up.
6. Calm and reassure patient.

If you are a caregiver of a child who is a known asthmatic, make sure the parents leave the child's medications with you, along with specific instructions on how and when to administer them. (There may be various ways to administer these medications, such as orally, by injection, or via inhalers or nebulizers.)

Many people with a history of asthma or allergic reactions carry medication to take in the event of a respiratory emergency. The victim uses a prescription inhaler by squeezing the device and propelling a measured dose into the mouth. The patient inhales while delivering the dose to get the medication into the lungs. Prescription inhaled medications relax the smooth muscle tissue of the bronchial tubes and opens them up, making it easier to breathe.

Only assist a person with an inhaler if the prescription is in his or her name and the medication is not expired. Ensure that the victim is responsive and cooperative and can hold and squeeze the inhaler him or herself prior to assisting with the inhaler.

**Using a Quick-Relief Inhaler:**[158]

Help the person follow the steps to use a prescription quick-relief inhaler.

1. Locate the inhaler and confirm it is prescribed to the patient and the expiration date has not passed.
2. Shake it vigorously a few times.
3. Remove the cover and attach the spacer if there is one.
4. Instruct the person to fully exhale.
5. Place the inhaler in the person's mouth and press down on the inhaler canister as the person inhales slowly and deeply.
6. Instruct the person to hold her breath for 10 seconds.
7. Repeat with a 2nd dose after a few breaths.

When treating a child, the use of a "spacer" with the inhaler is often recommended.

- It allows the full dose of the inhaled medication to flow down the child's trachea into the lungs, and prevents the medication from sticking to the back of the throat.
- One end of the spacer is attached to the inhaler and the other end can be affixed to a mask for small children or go directly into the mouth of a larger child.

Inhaled medication is safe to use. Side effects can include increased heart rate, shaking and nervousness. The heart rate may decrease as the airways are opened up and breathing becomes easier. The side effects from an inhaler are more a nuisance than dangerous.

Encourage fluids. An asthmatic child's hydration status is put at risk from excessive sweating and hyperventilation. Be sure that fluids are warm or room temperature, as cold fluids often trigger a reflex bronchospasm.

Identify a patient's attack triggers, and try to avoid them in the future (except exercise). Call 9-1-1 immediately if you suspect a severe asthma attack or if an inhaled treatment isn't working.

# Responding To Emergencies

## What is an Emergency?

An emergency is an unexpected occurrence that demands serious attention. Emergencies can happen anywhere and usually when you least expect them. Be prepared for an emergency before one happens.

Without an adequate assessment of scene safety, responders can quickly change roles from rescuers to victims, adding confusion and the need for more resources to an already difficult situation. Get your students thinking about:

- Letting someone know where he or she is going before entering an emergency scene.
- Ensuring that EMS has been called.
- Sizing up potential hazards.
- Sizing up the number of victims and a general idea of their condition and what happened.
- What resources they have available to them.
- Remembering treatment priorities.
- The fact that safety on any emergency scene is not guaranteed, and that an emergency scene can quickly change from safe to unsafe.

The most important actions to take during an emergency are to remain calm, stay aware of your own safety, and activate the EMS system or your workplace internal Emergency Response Plan when appropriate.

### How do I get help?

Dial 9-1-1 or your local emergency response number. If you are not sure what number to call, check in the front of your local telephone directory. When you dial 9-1-1, it's free, even from a cell phone with no current contract. About 70% of 9-1-1 calls are made from wireless telephones.[159]

Many businesses have a different procedure to activate EMS, such as calling the in-house operator. Make sure all employees know how to activate EMS while at work. Post the emergency response number prominently next to every telephone, first aid kit and AED.

### When should I get help?[11,160]

Call 9-1-1 or your local emergency response number for anyone who is seriously ill or injured. Examples include:

- Unresponsive, change in level of responsive or mental status
- Difficulty breathing or no breathing
- Bleeding that is severe or uncontrolled, or from body openings (e.g. mouth, nose, ears)
- Chest or abdominal pain or pressure
- Severe pain

- Sudden weakness, dizziness, change in vision or speech
- Serious burn or injury
- Suspected broken bone
- Vomiting or coughing up blood
- Head, neck or back injury
- Suicidal or homicidal feelings
- Signs of heart attack, stroke, or shock
- Seizure
- Suspected poisoning

Don't delay calling 9-1-1! Statistics show that a person has a better chance of surviving an emergency when EMS is activated early. If you postpone calling 9-1-1, the seriousness of the injury or illness and the risk of death can increase.

If you are not comfortable with a situation, or you are not sure if you should call 9-1-1, err on the side of caution. Call 9-1-1 and the dispatcher will ask questions to help determine if it is an emergency.

Do not assume someone else will activate EMS. If you ask someone else to call 9-1-1, have the person report back to you. Do not transport someone in your own car to the hospital if he or she has an injury or illness that could be aggravated by transport or that may become life-threatening. EMS responders can usually transport a victim to the hospital faster than you can, and provide essential care on the way. Delay = Death.

**What happens when I call 9-1-1?**[3,161]

***When you activate EMS:***

- You are connected to a law enforcement or fire department/emergency medical dispatcher (EMD).
- While the dispatcher is talking with you, he or she is simultaneously sending help your way.
    - Many people get frustrated when calling EMS because they think the dispatcher is taking too much time to send help to the scene.
    - Emergency Medical Dispatchers often work in tandem: one talks with the caller, while the other dispatches the units. Help is coming while the caller is giving valuable information that will be passed on to the professional rescuers en route to the scene.
- Let the dispatcher drive the call. Be prepared to provide the following:
    - Your name
    - Location of emergency
    - Telephone number that you are calling from
    - What happened (fall, auto crash, etc.)
    - Hazardous conditions
    - Number of persons needing help
    - Condition of the victim (awake, breathing, injured, dangerous position)
    - What aid is being given (CPR, AED use, controlling bleeding, etc.)

    - History (recent major medical event, chronic medical condition)
    - Any other information requested
    - Do not hang up unless instructed to do so by the dispatcher.
- The dispatcher may give you instructions to aid in helping the victim, such as compression-only CPR.
- Remain calm, follow instructions, and always hang up last.

## REACT to an Emergency

EMS Safety uses the acronym REACT to help students remember how to respond to an emergency.

**R – Recognize the emergency**

Pay attention to sights, sounds and situations that are unusual. Look and listen for any of the following: screams or panicked facial expressions; a person who is grimacing, having trouble breathing, clutching his or her chest, or who has slurred speech; a stopped car in the road containing a person who is not moving; severe, uncontrolled bleeding; and any problem involving pregnancy.

Remain calm and in control of your feelings. When you know you're going to respond to an emergency, your body releases adrenaline and your heart rate and blood pressure go up. Before it takes over, take a moment to gather your thoughts and establish your priorities. The first priority is to be safe! Taking a moment to focus and prioritize can help protect your life and put what you're about to do into perspective.

**E: Environment:**

**Size-up the scene** before you enter it. What are the potential hazards you face? Common hazards include:

- **Traffic**: Use your vehicle, hazard lights, reflectors and bystanders to control traffic around the scene. Watch for jagged metal and broken glass. Don't turn your back to oncoming traffic. Park your vehicle to protect the scene.
- **Fire or smoke**: Stay low to avoid smoke inhalation, focus on escaping and calling 9-1-1. If possible, drag the victim to safety. Never enter a smoke-filled environment.
- **Wet, icy or unstable surface or structure**: Slips, falls, vehicle movement, and structural collapse can cause additional injuries to bystanders and rescuers. Avoid walking onto a frozen lake or pond if the stability of the ice is unknown.
- **Downed electrical wires**: Do not enter the scene; maintain a safe distance. If downed lines are near your car, stay inside the vehicle.
- **Hazardous materials/chemicals/gasses**: Unusual smells, hissing sounds, liquids, hazardous containers; dead birds, animals, and fish could indicate a biological or chemical hazard.
    - Leave the area and report it immediately.
    - Refer to Material Safety Data Sheets (MSDS) where available. They provide a listing of chemicals used at a specific location and can help identify:

    - The types of chemicals likely to be present and their properties.
    - Effects of exposure to the chemicals listed.
    - Treatment for exposure to the types of chemicals listed.

- **Open water, swift/strong currents**: Do not attempt a water rescue without professional training and equipment. It only takes a foot of swift moving water to move a car downstream.
- **Confined spaces**: A confined space is any space where gas or noxious fumes can become trapped, such as a cave, sewer, drainage culvert, or someone's garage. Look for clues such as more than one victim with no apparent injury. Do not enter a confined space without proper equipment and training.
- **The victim:** Blood or body fluids are commonly present at accident scenes. Use Personal Protective Equipment when helping a victim to protect from bloodborne and airborne pathogens. Do the victims or bystanders appear agitated or hostile? Consider waiting for help if you are unsure of the safety of the scene.

**Plan your exit** before you enter an emergency scene. Identify two possible exits. Always let someone know where you are going and what you intend to do. Continually reassess the scene for danger. **If the scene doesn't look safe, do not enter it. Secure the area and call for help.**

**Size-up the victim.** How many victims? Are many people showing similar symptoms? Be alert to multiple victims with similar symptoms, as that could indicate a toxic or low oxygen environment.

- What appears to be their general condition? Assess level of distress or lack of movement.
- Can you identify the cause of the illness or injury? This can help identify the potential for severe injury.

**A – Assess the victim**

Assess the victim for responsiveness, breathing, and serious or life-threatening illness or injury that may require CPR, bleeding control, or EMS response.

**C – Call for help**

Shout for help and call 9-1-1 or your emergency response number to get professional help on the way if there is danger or if the victim is unresponsive or seriously ill or injured. With a serious medical emergency, transport to a hospital in the first hour (the golden hour) is critical to survival.

Activate your workplace Emergency Action Plan (OSHA Publication 3088).[162]

**T – Treat the victim**

Prioritize treating problems related to breathing and circulation first. Treat the person in the position found, unless there is danger or the person needs to be repositioned for essential care or a position of comfort.

## Interacting with EMS Personnel[9]

A smooth transfer of care from a first aid provider to EMS responders is important in order to provide the best care and avoid wasting valuable time. Although a first aid responder's initial reaction may be to step back when EMS personnel arrive, actually he or she should continue care until formally relieved by EMS personnel. The first aid responder should work together with EMS personnel during the transfer of care.

**Before EMS responders arrive:**

- Send a bystander out to meet EMS.
    - Turn on outside lights.
    - Secure your pets.
    - Unlock your front door.

**When EMS responders arrive:**

- Continue care while EMS responders prepare equipment and additional rescuers arrive.
- EMS personnel will notify the first aid responder when ready to assume care.
- Be ready to assist EMS personnel with additional patient care tasks if asked:
    - Continue to stabilize a suspected neck or back injury.
    - Continue performing chest compressions; relieve other rescuers.
    - Provide AED shock if indicated by the AED prompt.
    - Continue to apply pressure to a bleeding wound.
    - Help lift a patient to a stretcher.
    - Any other task within the first aid provider's level of training.
- Communicate to EMS:
    - The time the event occurred, and what time you began care.
    - The treatment given to the victim.
    - Information gathered during interviews of the victim, family and bystanders.
    - Information from your initial assessment.
    - A printed list of medications if available.
    - A child's Emergency Information Form (from school or childcare facility)

**After an emergency:**

- Give EMS any contaminated dressings, PPE, and used epinephrine pens.
- Keep the victim's information private.
- Restock the first aid kit.
- Report the incident to your supervisor at work; complete any required paperwork.

## Rescuer Stress[163,164]

Giving care in an emergency may have physical, mental, and emotional consequences for the rescuer. Each rescuer will respond differently to stress, depending on his or her experience and personality, and also on the seriousness and outcome of the incident.

It's normal to feel stress after an incident. The response usually lasts just a few days. If a rescuer is unable to cope with the stress produced by the incident, the effects may last for weeks or even months and affect a person's health, family life, and work performance. The signs and symptoms of incident stress may include the following:

**Physical Response**

- Rapid breathing or heart rate
- Trembling
- Sweating
- Nausea, diarrhea
- Headache, muscle ache
- Fatigue
- Difficulty sleeping
- Increased or decreased appetite

**Mental Response**

- Cannot stop thinking about the event
- Confusion, difficulty concentrating
- Nightmares

**Emotional Response**

- Anxiety, worry, guilt, fear, anger
- Depression, crying
- Restlessness
- Change in behavior or interactions with people

To keep post-traumatic stress from developing, don't ignore signs of stress. Take care of yourself by eating properly, avoiding alcohol, drugs and caffeine, exercising, and getting enough rest. Talk about your feelings with someone who has had a similar experience. Don't judge yourself for your actions, and get professional help if needed.

# Seizures

## Overview[165,166,167]

A seizure is an abnormal electrical discharge in the brain. The symptoms displayed will depend on the cause of the seizure and the part of the brain that is affected. It may affect only one part of the body (focal seizure), or may affect the whole body (generalized seizure). Some seizures involve unusual sensations, visual disturbances or staring spells that can easily go unnoticed. Seizures are a relatively common medical disorder. They can occur at any time or place.

Many seizure conditions are kept in check with medication, but the body may develop a tolerance to the medication and the person will experience another seizure. In addition, most seizure medications become ineffective when mixed with alcohol. Many people may take their medication inconsistently, which also makes it ineffective.

A seizure may last from a few seconds to several minutes. Most seizures will stop by themselves after a period of time. A physician is needed to determine the cause of first time or repeated seizures.

About 10% of the U.S. population will have a seizure during their lifetime. Almost 3 million Americans currently have epilepsy, with an additional 200,000 developing seizures and epilepsy each year.

**Seizures have a beginning, middle and end:**

1. **Aura** – A premonition of an impending seizure. It can be a strange feeling, a particular taste, smell or sensation. If someone tells you he thinks he is going to have a seizure, believe him. A seizure victim may or may not be aware of the beginning of the seizure.
2. **Ictus** – The actual seizure.
3. **Post-ictal** – The recovery period for the brain; a period of lethargy and extreme exhaustion following a seizure. It is normal, and you should not try to awaken the person. As the person regains consciousness, he may be extremely confused and combative. Actual symptoms vary according to the type of seizure. At this time the person may not be able to protect his own airway; rescuers should ensure that the airway is open.

## Types of Seizure[165,166]

There are several different types of seizure. A **partial seizure** (**focal seizure**) affects only a portion of the brain. Symptoms may include abnormal sensations, personality or emotional changes, nausea or sweating, muscle contractions of a specific body part, or other localized symptoms. The person may or may not lose consciousness.

A **generalized seizure** (petit mal or grand mal seizure) affects all or most of the brain. A **petit mal seizure**, also known as an **absence seizure**, is characterized by a sudden lack of conscious activity or other abnormal change in behavior. The victim stops all activity and speech, and then resumes one to several seconds later. The seizures may be infrequent, or may occur very frequently. They occur most often in people under age 20, usually in children ages 6-12. Since the seizure can appear as a staring episode, it is often thought that a child is simply daydreaming. The cause of petit mal seizures is usually unidentifiable.

The most common seizure requiring first responder intervention is the **grand mal seizure**, also known as a **tonic-clonic seizure**. This is the type that most people associate with the terms "seizure," "convulsion" or "epilepsy."

**The following is the typical sequence of events during a grand mal seizure:**

1. The seizure begins with the tonic-clonic phase, as the patient becomes unconscious and the entire muscular system becomes involved. The patient stiffens his arms and legs and arches his back; twitches and jerks are common.
2. The person is unresponsive for the duration of the seizure.
3. The person's skin may turn a bluish color due to a lack of oxygen during the seizure. Breathing is often irregular or stops temporarily, and oxygen does not reach the skin cells in adequate amounts. After the seizure the person resumes breathing, but may need assistance maintaining an open airway.
4. The person may bite his or her tongue or cheek, and be incontinent (loss of bowel or bladder control).
5. After the seizure, the person may remain unresponsive or be confused and weak.

## Causes of Seizure[167,168]

Causes of seizure include brain tumor, brain injury, stroke, drug overdose (especially cocaine or stimulants), alcohol or drug withdrawal, poisoning, low blood sugar (hypoglycemia), infection (brain abscess or meningitis), a sudden lack of oxygen to the brain, or a heat-related emergency. Sometimes the cause of a seizure is unknown (idiopathic). The most common cause of seizure is epilepsy.

**Epilepsy** is a chronic disorder that involves recurrent seizures of any type. It is diagnosed when a patient has had two or more seizures. The normal pattern of brain cell (neuron) activity is disturbed, resulting in strange sensations, emotions or behavior, and sometimes muscle spasms, seizures, and loss of consciousness.

Epilepsy (seizure disorder) can affect people of any age. It is most likely to develop in early childhood and old age. Risk factors include head injury or other conditions that cause damage to the brain (e.g. stroke), and a family history of epilepsy. It is controlled through medication and surgical techniques in about 80% of patients. Factors that may contribute to worsening seizures in a person with normally well-

controlled seizures include pregnancy, illness, certain prescribed medications, skipping doses of medication, use of alcohol or recreational drugs, or lack of sleep.[3]

**Febrile seizures** are triggered by a rapid rise of body temperature usually to over 102° F. They are most common during the first two years of life, but can be seen in children up to four or five years of age. The brain stem, which regulates body temperature, does not mature until age four. This results in a child's body temperature rising quickly when he or she becomes ill. About 3-5% of children between 9 months and 5 years will have at least one febrile seizure.[169]

A febrile seizure can be as mild as the child's eyes rolling or limbs stiffening, or may be a grand mal seizure. If a febrile seizure is suspected, follow seizure treatment guidelines, beginning with assessing response, breathing, circulation and appearance. Cool the febrile child by removing all clothing and sponging with lukewarm water. Stop the cooling process if shivering or goose bumps become evident. Most febrile seizures are harmless. There is no evidence that febrile seizures cause brain damage.

**Signs and Symptoms of Seizure:**

- Muscle twitches, rigidity, violent rhythmic muscle contractions
- Staring, eye movements
- Lip smacking, mouth movements, drooling, tongue biting
- Head turning, purposeless movements
- Abnormal sensations, hallucinations
- Nausea
- Dilated pupils
- Sweating, flushed skin
- Incontinence
- May or may not lose consciousness and awareness

**Treatment During the Seizure:**

1. Place victim on the floor; remove nearby objects and furniture.
2. Protect the victim's head from injury with a small pillow or other soft object such as a blanket or jacket. Ensure that you do not close the victim's airway or restrict movement by raising the head too high.
3. Activate EMS (call 9-1-1).
4. Loosen any tight clothing, especially around the neck.
5. Ask spectators to leave.
6. Time the seizure.

**Do not** put anything in the victim's mouth. The object may break and obstruct the patient's airway.
**Do not** restrain the victim.
**Do not** move the victim unless he or she is in a dangerous location.

**Treatment After the Seizure:**

1. Assess response, breathing, circulation and appearance. A person having a seizure might be injured, inhale food, fluid or vomit into the lungs, or not get adequate oxygen.
2. If potential spinal injury, treat head and neck as a unit to prevent further injury.
3. If fluids or vomit in the mouth, place in recovery position. Turning the person on his or her side will help expel any vomit and keep the airway open.
4. Cool a febrile seizure patient.
5. Ensure EMS has been activated.
6. For a febrile seizure patient, give the normal dose of ibuprofen or acetaminophen when the child is completely awake.

**Do not** give food or drink until the person is completely awake and alert.

After a generalized seizure the person will be sleepy for one hour or longer and may not remember the seizure episode. A physician should evaluate all seizure victims. Even if the person is known to have recurrent seizures or epilepsy, medications may need to be adjusted or other instructions given. Record details of the seizure: date, length of time, type of symptoms, which body parts were affected, behavior after the seizure, and any other pertinent information.

## Fainting[170]

Fainting (**syncope**) is a brief loss of consciousness usually caused by a momentary lack of blood supply to the brain. Awareness of self and surroundings should recover spontaneously. Fainting is a common problem, and accounts for 3% of patient visits to emergency departments.

Fainting can be caused by dehydration, temporary low blood pressure or low blood sugar, or may be related to environmental, emotional or physical stress. A change in position from lying to sitting or sitting to standing can cause **postural hypotension** (**orthostatic hypotension**), which is a decrease in blood pressure resulting in inadequate blood supply to the brain. Fainting can also occur after urinating, defecating or coughing (vasovagal reaction). Since fainting may be related to medications or a serious heart or other medical condition, it is important to contact your physician for evaluation.

If the signs and symptoms of fainting do not pass relatively quickly (1–2 minutes), treat the loss of consciousness as a medical emergency and activate EMS. Since people who lose consciousness may vomit, ensure that the airway remains unobstructed.

If you feel lightheaded or faint, lie down. If you can't lie down, then sit down with your head between your knees to get the blood flowing to your brain. Do not stand up until you feel better. Be aware that if you do faint while seated with your head between your knees, you may sustain head, neck or other injuries from a fall.

If someone else faints, position the victim on his or her back. Monitor the airway and ensure that it remains open.

**Signs and Symptoms:**

- Lightheadedness
- Blurred vision
- Nausea
- Pale, sweaty skin
- Brief period of unconsciousness

**Treatment:**

1. Use shock position until dizziness passes.
2. Loosen restrictive clothing.
3. Activate EMS if victim remains unresponsive or is injured.
4. Treat any injuries sustained if the victim fell when fainting.

# Shock Management

## Overview[37,171]

The body must have two basic things to survive: oxygen and glucose (sugar). Both of these are carried by the blood to nourish the body's tissues. Shock is a life-threatening condition that occurs when there is inadequate blood flow (perfusion) to the vital organs and body tissues. Perfusion is dependent on heart rate (pump), fluid volume (blood), and a container for the blood (vessels). Interference with any of these components can affect perfusion.

Shock requires immediate medical treatment, or the victim may die. The goals of first aid care are to treat the underlying cause of shock, maintain body temperature, and get medical help. Early intervention through bystander first aid can prevent shock or keep it from getting worse. Treat shock before it progresses.

## Types of Shock:

- **Hypovolemic:** Fluid or blood loss of at least 1/5$^{th}$ of the normal blood volume. Causes may include the following: internal bleeding from the gastrointestinal (GI) tract or other source; external bleeding from trauma; inadequate blood volume due to vomiting or diarrhea; fluid loss due to burns.
- **Cardiogenic:** Heart-related. There is adequate blood volume, but the heart cannot effectively pump the blood due to heart attack, heart failure, trauma to the chest, or another cardiac condition.
- **Anaphylactic:** Allergic reaction that involves the entire body (systemic). Once a person has been exposed to an allergen, a subsequent exposure can trigger a sudden, severe, life-threatening reaction in which the airways constrict, causing difficulty breathing, and the blood vessels dilate, resulting in decreased blood pressure. Examples include allergies to food, drugs, or bee stings.
- **Neurogenic:** Nervous system injury. The injury may cause vasodilation and pooling of blood, with subsequent decrease in blood pressure (e.g. spinal cord injury).
- **Septic:** Severe blood stream infection (e.g. blood poisoning)
- **Psychogenic:** A sudden dilation of blood vessels due to extreme emotion. (e.g. fainting spell).

Signs of shock are not always obvious, and may even appear hours later. Signs and symptoms may vary according to the cause. Suspect shock in cases of severe external bleeding. Internal bleeding may be hidden, but can also cause shock.

When a victim displays early signs of shock, do not delay calling for emergency help. The victim's condition can deteriorate very rapidly. Early medical care can minimize damage to vital organs such as the brain and kidneys, or even save a life.

**Signs and Symptoms:**

- Pale, cool, moist skin

- Weak, rapid pulse
- Rapid, shallow breathing
- Very low blood pressure
- Nausea and/or vomiting
- Emotional unrest or confusion
- Dizziness or faintness
- Chest pain
- Dull, vacant eyes; dilated pupils
- Excessive thirst
- Decreased urine output
- Unresponsiveness
- Signs and symptoms of allergic reaction (wheezing, hives, itching, skin redness, abdominal cramping)

An increased heart rate can indicate that the person's heart is trying to compensate for decreased blood flow to vital organs.

**Treatment:**

1. Assess response, breathing, circulation and appearance.
2. Activate EMS (call 9-1-1).
3. Lay the victim down. This will improve blood flow to vital organs in the core of the body.
4. Control external bleeding; treat fractures as indicated.
5. Maintain body temperature. Normal body temperature is 98.6 F. It may require warming a cold patient or cooling a hot patient. If cold, cover with a blanket; replace wet clothing with dry. Insulate the victim from the ground if needed (e.g. place a blanket underneath the victim).
6. Loosen tight clothing.
7. Monitor status every 5 minutes.
8. **Do not** give the person anything to eat or drink. This may delay any necessary surgery, or cause vomiting.

Elevating the legs when there are signs of shock has not been proven through research to be beneficial as a first aid maneuver, so it will not be taught in a basic first aid course.[23] There is also the risk of the first aid provider causing harm to the victim by missing signs of a spine, pelvic or leg injury.

# Stroke

## Introduction

A stroke (**cerebrovascular accident** or **CVA**) is a general term that describes an injury to the brain caused by a disruption of blood flow to a region of the brain. A stroke is just like a heart attack, but occurs in the brain. The term "brain attack" has been used to signify the importance of early recognition and treatment of stroke symptoms.

The brain relies on oxygen and sugar (glucose) to live. When blood flow to the brain is interrupted, brain cells in the affected area begin to die. The severity of a stroke is determined by the size and location of the area affected by the lack of oxygen. If the stroke is not fatal, the person may have permanent disability.

Every 40 seconds someone has a stroke in the U.S. Stroke is the third leading cause of death in the United States and most other countries, and is the leading cause of brain injury in the U.S. About 800,000 Americans suffer a first or recurrent stroke each year. More women than men have strokes, primarily due to the longer life expectancy of women, and the increased risk of stroke with increasing age.

Annually more than 136,000 strokes are fatal, with more than half of them occurring out of the hospital. There are over 7 million stroke survivors in the U.S., many of whom have permanent stroke-related disabilities.[69,172] Recognition of stroke symptoms by family members and rapid medical intervention is critical to reducing death and disability. Certain treatment options are only available to a stroke victim within a few hours of the onset of symptoms. Like a heart attack, delay equals cell death.

## Clot vs. Bleed[69]

There are two categories of stroke. An ischemic (clot-type) stroke results from the blockage of a cerebral artery. A hemorrhagic stroke usually results from the rupture of a weakened portion of a blood vessel wall that is overstretched and bulging due to hypertension (aneurysm) or a malformation of blood vessels. The result is bleeding into brain tissue. It is important to note that both types can be fatal.

### Hemorrhagic Stroke

Although both types of stroke can be deadly, clot-related stroke rarely leads to death within the first hour, while hemorrhagic stroke can be fatal at onset. When a rupture in a cerebral artery occurs, the onset of signs and symptoms occurs quickly and with little warning. Hemorrhagic stroke accounts for approximately 13% of all strokes. The most common cause of hemorrhagic stroke is hypertension (sustained high blood pressure). Emergency surgery is usually required to resolve this life-threatening condition.

### Clot-Type Stroke

A clot-type (ischemic) stroke is caused by a traveling clot (embolus) or a blockage (thrombus) that forms in a cerebral artery. Clot-type strokes are the most common type of stroke, and are responsible for about 87% of all strokes. [69]

## Transient Ischemic Attack (TIA)

A TIA, often termed a minor or baby stroke, is a temporary lack of oxygen to the brain that results in transient stroke symptoms. The cause is the same as that of an ischemic stroke. The symptoms of a TIA usually resolve without intervention within the first 60 minutes, with all symptoms gone within 24 hours.

TIAs are considered a warning sign of an impending stroke. About 10% of TIA victims will develop a stroke within 90 days, and up to 13% will die within a year. TIA victims should be evaluated by their physician to identify ways to reduce the risk of a major stroke, yet only half actually report a TIA.[69] Medications, surgery and lifestyle changes can reduce the risk of subsequent stroke in patients with TIA.

## Risk Factors Associated with Stroke[69,174,175]

Similar to a heart attack, some risk factors of stroke are controllable, while others are beyond our control. We all should be aware of the risk factors and do what we can to prevent or reduce our risk of stroke. Combined risk factors significantly increase the prevalence of arterial disease and the occurrence of stroke.

### Controllable Risk Factors

Reducing the controllable risk factors associated with stroke is paramount to living a long and healthy life. Consult your doctor before beginning an exercise program or significant lifestyle changes. Your doctor can identify your risk factors, and then develop a plan to reduce your risk. Efforts at reducing risk factors can be focused on the following activities:

**Smoking:** Smoking is the number one preventable cause of serious illness such as heart disease, stroke and lung cancer. It reduces the amount of oxygen in your blood, and increases heart rate and blood pressure.

**Physical Activity/Obesity:** Physical activity affects blood pressure, reduces cholesterol levels, helps control weight, reduces the risk of diabetes and reduces stress. Obesity (30 pounds or more overweight) is a significant risk factor for heart attack and stroke. It is caused primarily by eating more calories than are burned through daily activity. The excess calories are stored as fat. Maintain a healthy weight with a varied, healthy diet, more appropriate portions, regular exercise and increased daily activity. Consult your doctor prior to beginning an exercise program.

**Diet:** Foods that are high in saturated fat, trans fat and cholesterol contribute to heart attack and stroke. Healthy foods (a variety of fruits, vegetables, whole grains, low in saturated fat) reduce risk. High salt intake can lead to high blood pressure. Eat a varied, healthy diet with plenty of fruit and vegetables.

**Excessive Alcohol:** Studies indicate that one or two drinks a day may increase "good" cholesterol (HDL); however, heavy drinking can lead to high blood pressure, heart disease and stroke.

**High Blood Pressure and High Blood Cholesterol**: Hypertension and high blood cholesterol levels are direct contributors to heart attack and stroke. Keep levels low through regular checkups with your doctor, exercise, a healthy diet and medication as needed.

A good blood pressure is 120/80 mm Hg. If it's over 120/80 mm Hg, have it checked more often and report your findings to your doctor. High blood pressure is considered to be 140/90 mm Hg or higher. Sustained high blood pressure (hypertension) is known as the "silent killer," as it occurs over years without signs or symptoms. Hypertension causes damage to the blood vessels and increases risk of heart attack and stroke.

High levels of cholesterol are associated with heart disease. Low Density Lipoproteins (LDL) carry cholesterol to the tissues and arteries. High Density Lipoproteins (HDL) carry cholesterol to the liver to remove it from the body. When there is too much LDL circulating in the bloodstream, plaques (cholesterol and other materials) build up on the inside of the artery walls, leading to narrowing of the inside of the artery and hardening of the artery wall.

Good levels of cholesterol: <100 mg/dl LDL; >60 mg/dl HDL; <200 mg/dl total cholesterol.

**Diabetes:** Diabetes leads to vascular disease, which automatically increases the risk of heart disease and stroke. With medical care, diabetes can be detected and controlled**.** With a healthy diet, exercise, and healthy weight, type 2 diabetes can often be prevented.

**History of TIA:** Recent or repeated 'baby' strokes.

**Non-Controllable Risk Factors**

**Age:** The older we get, the higher our risk of heart disease and stroke.

**Sex:** Each year more women than men suffer from a stroke.

**Hereditary:** A family history of heart disease or stroke is a strong indicator of increased risk. For persons with a family history of heart disease or stroke, it is even more important to identify and control the other risk factors.

**Race:** African Americans are more likely than Caucasians to have high blood pressure, and tend to have strokes earlier in life and with more severe results.

## Recognition of Stroke

The onset of stroke symptoms is usually sudden and can encompass a range of signs and symptoms. Not all signs and symptoms need to be present. The types of symptoms experienced during a stroke can vary depending on the portion of the

brain affected (i.e. if the speech center is affected, the victim's slurred speech may be the most prevalent sign of a stroke).

The brain is the nerve center for the body; impulses from the brain control nearly every aspect of our body. When brain cells are injured by a stroke, the injury affects the part of the body controlled by that portion of the brain. The brain is divided into two hemispheres, each of which controls the opposite side of the body. The symptoms of a stroke commonly affect only one side of the body, but may be present in both sides.

Families of those at risk for stroke should be educated on the signs and symptoms of stroke. Early medical intervention is critical.

**Signs and Symptoms of Stroke**

- Sudden weakness or numbness of the arm or leg, usually on one side of the body
- Facial droop or paralysis, usually on one side
    - Ask the stroke victim to smile or show his or her teeth.
    - A drooping cheek or corner of the mouth is an indicator of stroke.
- Difficulty speaking
    - A stroke may affect the speech center of the brain.
    - Slurred, garbled or confused speech is a sign of stroke.
- Difficulty swallowing
    - Drooling
    - Coughing when attempting to eat or drink
- Altered level of consciousness
    - Confused, unresponsive, lethargic
    - Remember that hearing is the last sense to go when we become unconscious. Rescuers should refrain from discussing the severity of the patient's condition or from making inappropriate comments.
- Sudden dizziness or severe headache with unknown cause
- Unsteadiness, sudden falls or other sudden lack of coordination or balance
- Visual disturbances such as the loss of vision in one eye

***Quick Stroke Assessment***[176]

Use S-T-R, the first three letters of stroke, to remember common signs of stroke.

**S**: Smile. Ask the person to smile. Look for a lopsided or uneven smile.

**T**: Talk. Ask the person to say a simple statement, such as "You can't teach an old dog new tricks." Listen for slurring or incorrect use of words.

**R**: Reach. Ask the person to close his or her eyes and raise both arms up. Look for uneven movement or strength.

A victim of stroke will often have sudden weakness on one side of the body, or difficulty speaking or using words correctly. Suspect stroke if any of these signs are present, and call 9-1-1 immediately. Give the time of the onset of signs and symptoms.

**Delays in Calling 9-1-1**[178]

Rescuers should err on the side of caution when considering the signs and symptoms of a stroke. If the victim shows any of the signs and symptoms of stroke, call 9-1-1 (activate EMS).

Some people who recognize stroke symptoms may still not call 9-1-1. A recent study found that almost 40% of people who recognize at least one stroke symptom would choose to give first aid, call their doctor, stay with them until they feel better, or drive them to the hospital instead of calling 9-1-1.

The correct action is always to call 9-1-1 for even one stroke symptom. EMS responders will be available to help if the victim's condition gets worse, can get to the hospital fast, and will often contact the hospital to prepare them for the suspected stroke victim.

**Treatment of Stroke**

Call 9-1-1 at the earliest onset of stroke symptoms. Do not assume that a victim is having a TIA and wait for symptoms to resolve. Early recognition of the symptoms of a stroke is essential to reduce associated death and disability. Recent advances in the treatment of stroke have produced new medications that are incredibly effective, but only work in the early hours of a stroke.

**When you suspect a stroke, take the following actions:**

1. Call 9-1-1 (activate EMS).
2. Protect the airway.
    a. May have trouble controlling the tongue or managing secretions.
    b. If fluids or vomit in the mouth, place in the recovery position to allow fluids to drain.
3. Calm and reassure the victim.
4. Note the time that symptoms began.

**If the person is unresponsive:**

1. Check for breathing.
2. If no breathing or only gasping, begin CPR.

**Fibrinolytic Therapy – The use of "Clot-Busters"** [69]

When clot-busting medication, or rtPA (recombinant tissue plasminogen activator), is administered to the victim of a clot-type stroke, it is known as fibrinolytic therapy. Protocols suggest that fibrinolytic therapy has to be administered within three hours of the onset of symptoms in order to be most effective at limiting neurological damage. Sadly, fewer than 10% of appropriate patients can receive fibrinolytic therapy because most victims reach the hospital too late.

Because of the narrow window of time between the onset of stroke symptoms and the effectiveness of fibrinolytic therapy, 9-1-1 should be called without delay if a stroke is suspected or a person is exhibiting stroke symptoms.

Since there is a risk of hemorrhage associated with the use of fibrinolytic therapy, clot-busting medications cannot be administered to someone with a hemorrhagic-type stroke, as it would worsen the bleeding into the brain tissue.

Fibrinolytic therapy can reduce the effects of a stroke by reducing or eliminating the clot at the source. It is administered through an intra-venous line and circulates through the blood stream. It will locate the clot and attempt to dissolve it. Receiving clot-busting medication could make the difference between lifelong disability or even death and a complete resolution of the stroke and its symptoms.

**Stroke-Prepared Hospital**

Due to the time sensitive nature of stroke, the development of stroke systems of care with improved public awareness has been an important part of decreasing mortality and disability from stroke. The greatest improvement has been in the area of the 'stroke-prepared' hospital.

A stroke-prepared hospital will have expertise in the following:

- Rapid triage, evaluation and management in the Emergency Department
- Fibrinolytic therapy and other strategies
- Rapid admission to the appropriate acute hospital unit

Further progress is needed in early recognition of stroke symptoms by the public, early activation of EMS, rapid EMS dispatch, and pre-hospital notification and patient transport to a stroke-prepared hospital. This "Stroke Chain of Survival" can have a significant impact on survival of stroke with decreased disability.[69]

**Racial and Ethnic Disparities in Recognition and Care of Stroke**

Despite improvements in prevention, recognition, and medical care of stroke, there remains a significant gap between minorities and Caucasians in stroke care. Improvement is needed in many areas: compliance with prevention, such as control of hypertension and diabetes; community education of stroke signs and the need for immediate care; cultural competence among EMS and healthcare providers; access to insurance coverage and care.[177]

# Traumatic Injuries

## Overview

Trauma is defined as "an injury or wound to a living body caused by the application of external force or violence." Acute trauma may occur when a sudden application of force or violence causes immediate damage to a living body. The most common cause of injury-related death in the US is motor vehicle accidents; gunshot wounds are the 3rd leading cause.[183]

## Gunshot Wounds[179,180,181]

There are more than 200 million privately owned firearms in the US. There were more than 30,000 deaths and 70,000 injuries by firearms in 2005.

One third of households with children or adolescents contain firearms, and one third of those firearms are not stored safely.[182] Most young children are strong enough to fire a gun, despite popular belief to the contrary. More than half of the unintentional firearm-related deaths among children occur in the home of the child, a relative or friend.

The most important factor when dealing with gunshot wounds (GSW) is scene safety. Once the scene has been secured, you can turn your attention to caring for the victim.

**Consider the following aspects of GSW:**

- Causes laceration, crushing and shock wave-type injuries.
- Can damage vital organs or major blood vessels.
- May cause exit wounds that are larger and bleed more than entrance wounds.
- Can ricochet off bones, causing more damage.

**Treatment:**

1. Call 9-1-1 for EMS and law enforcement.
2. Ensure scene safety.
3. Assess response, breathing, circulation and appearance.
4. Spinal immobilization if potential spinal injury.
5. Check for entrance and exit wound.
6. Control bleeding.
7. Keep the victim still.
8. Treat for shock.
9. Do not disturb potential crime scene evidence.

The definitive treatment is surgery to repair the damaged organs. Many GSWs are part of a crime scene; remember as much detail as you can and disturb as little of the area as possible.

## Crush Injuries[184,185]

Crush injuries occur when blunt force is applied to the body for extended periods of time (e.g. a car accident victim whose legs are trapped under the dashboard, or a structural collapse during an earthquake). Common injuries include fractures, lacerations, bruising, bleeding, and compartment syndrome (increased pressure or swelling in a section of muscle resulting in severe pain, decreased blood flow, and eventually tissue death if pressure is not surgically relieved).

The person's outcome is determined by the length of time the tissue is compressed and deprived of blood. Although the injury is localized, the whole body can be affected as muscle tissue breaks down and its toxic components are released into the body.

Emergency scenes that involve crush injuries are typically dangerous; secondary collapse should be considered a major hazard.

**Treatment:**

1. Ensure scene safety.
2. Activate EMS. (Call 9-1-1).
3. Assess response, breathing, circulation and appearance.
4. Severe Bleeding Treatment protocol
5. Spinal immobilization

## Impaled Object[14,37]

An impaled object injury occurs when the object that causes a wound remains deeply embedded in the skin. Treatment is focused on controlling bleeding while securing the object in place. In most cases the impaled object should not be removed. Removing the object may cause more damage and could increase bleeding.

**Treatment:**

1. Assess response, breathing, circulation and appearance.
2. Activate EMS. (Call 9-1-1.)
3. Expose the wound. Remove the clothing covering the wound if possible.
4. Apply direct pressure to control bleeding.
    a. Apply pressure on either side of the object.
    b. **Do not** apply pressure directly on the impaled object.
5. Stabilize the object in place.
    a. Use a bulky dressing or clean cloths and tape.
    b. If the object is impaled in an extremity and EMS is delayed, immobilize it with a splint.
    c. Secure at least ¾ of the object in place.
6. Calm and reassure the victim.

### DO NOT

**Do not** apply pressure directly on the impaled object.

**Do not** attempt to remove an impaled object.

- Removing the object may cause severe bleeding and more damage to the underlying area.
- Leaving the object in place may slow the bleeding, and could help identify organ involvement by the depth and angle of injury.
- A physician will ultimately remove the object in a controlled environment.

**Do not** attempt to shorten an impaled object.

- Motion of the impaled object may damage surrounding tissues.
- Consider cutting the object only if extremely cumbersome and transport is required.
- Leave the manipulation of the impaled object to EMS professionals, in most cases.

**Stabilizing an Impaled Object**:

1. Apply direct pressure at the wound edges to control bleeding.
2. Build up bulky dressings, bandages or clean cloth around the object.
3. Stabilize at least ¾ of the object.
4. Secure in place with adhesive tape.
5. Assess circulation below the bandage to ensure it is not too tight; reapply if any change in circulation, sensation or motion below the bandage.

**Impaled Object in the Cheek**

One of the only times a rescuer should consider the removal of an impaled object is when it is embedded in the cheek. When a foreign object is impaled in the cheek it should be removed, because massive bleeding with cheek injuries is associated with airway obstruction.

***Removing an Object Impaled in the Cheek:***

Gently feel the inside of the cheek to determine if the object has penetrated all the way through. If so, carefully pull the object out from the same side it entered. If there is difficulty removing the object, leave it in place; do not force the object out. When the object has been removed, pack the inside of the cheek (inside the mouth, between the teeth and cheek) with sterile gauze. Apply counter pressure with a dressing and bandage secured over the outside of the wound. Position the victim so that blood will drain out of his/her mouth if bleeding is significant.

## Amputation[186]

An amputation is a partial or complete loss of a body part due to an injury or accident. Bleeding may be minimal due to retraction of the blood vessels.

**Treatment:**

1. Assess response, breathing, circulation and appearance.
2. Activate EMS (call 9-1-1).
3. Apply direct pressure to the site of bleeding.
4. Treat for shock.
5. Wrap amputated part in dry sterile gauze. Put gauze in plastic bag. Put plastic bag into second bag filled with ice.

DO NOT **Do not** let ice come in direct contact with the amputated part or immerse it in water.

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